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THE FOUNDRY

Vol. 28, No. 5. *CLEVELAND, OHIO, JULY, 1906.* *Whole No. 167*

American Foundrymen's Association, Eleventh Annual Convention, Cleveland, June 6 to 7.

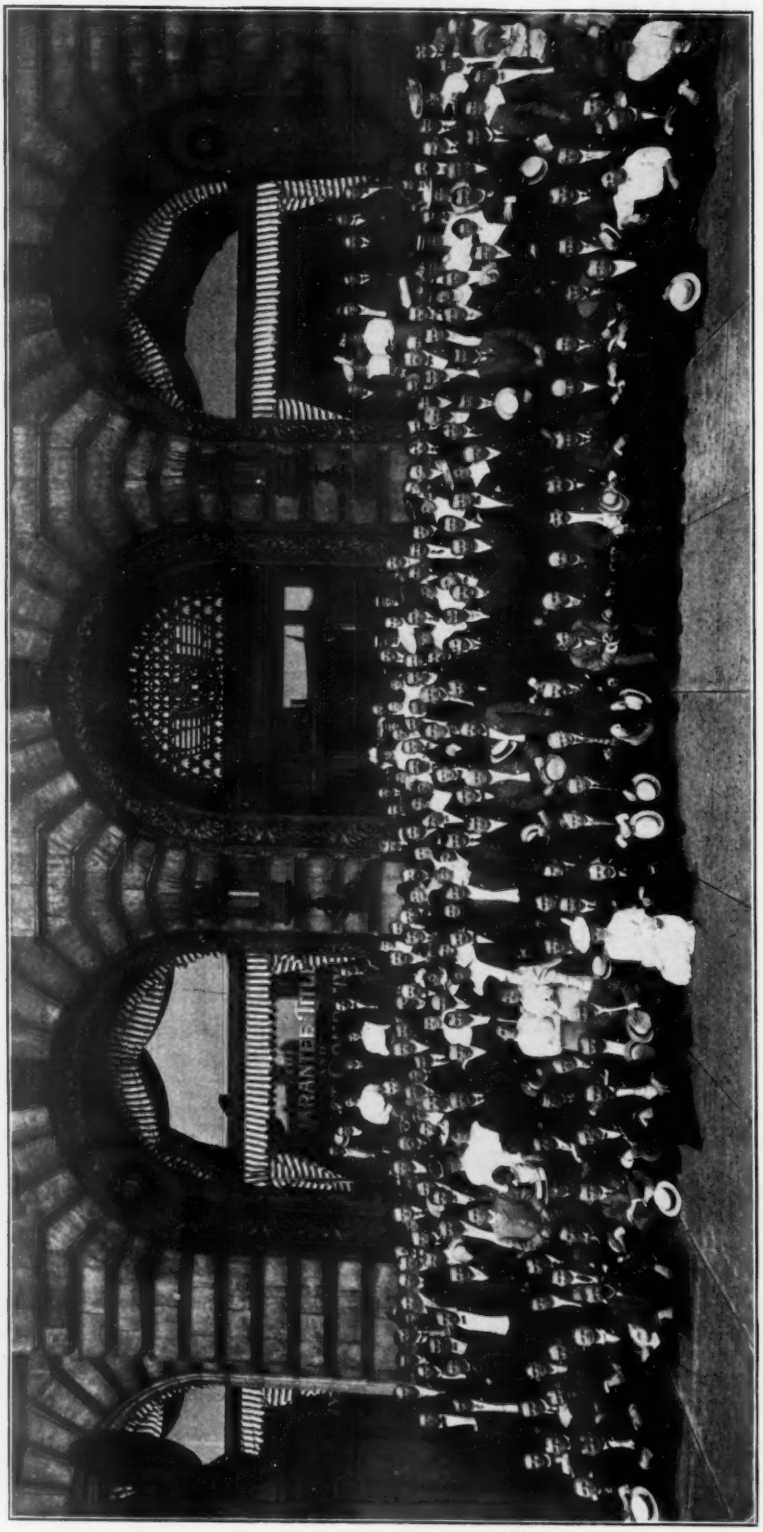
THE eleventh annual convention of the American Foundrymen's Association was marked with many features which are new and which show not only the past work of the association, but its growth and opportunities for future development. In the matter of papers alone, the interest taken by the different classes is shown.

The American Foundrymen's Association membership is composed of all who are interested in the foundry business. This is a pretty broad specification, and the classes interested are practically all represented in the list of contributors this year. Of the twenty-eight papers and reports presented, four were prepared by foundrymen, six by metallurgists, two by accountants, five by individual foremen, one by the Cleveland Patternmakers' Association, the membership of which is composed of patternmaker foremen, three were reports by the secretary or committees, three were prepared by manufacturers, two by college professors, one by an editor, and one a report by Dr. Stratton, of the Bureau of Standards, at Washington, D. C. Each sees the problem from his particular angle, and by coming together and reading these papers and discussing the subjects, great good to all classes results.

This year there was one feature which was somewhat different from previous years. That is, that all the sessions were presided over by the president of the A. F. A. and all papers presented to the parent association. For the last two years the president of the Foundry Foremen's Association has presided at one session, at which most of the Foundry Foremen's papers were read. This was impossible this year for two reasons: First, it was impossible for the president of the Foundry Foremen to stay past the first day of the convention, and the secretary of the Foundry Foremen's Association was also absent. Second, greater good can be obtained by grouping the papers according to subjects than by grouping them according to authors, and hence in presenting them it is best to arrange them for presentation to the parent body.

The American Foundrymen's Association, however, owes a great debt this year to the Associated Foundry Foremen for their part in the preparation of papers, in the attendance at the convention, and for the general interest taken in the meetings.

It is to be hoped that by another year other sections will be developed, which will be equally beneficial to the association.



MEMBERS AND GUESTS OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION AT CLEVELAND.

Associated Foundry Foremen.

The business session of the fourth annual convention of the Associated Foundry Foremen was held at the American house, Cleveland, O., on the evening of June 4, with a large attendance. President David Reed presided, and in the absence of the secretary, Henry M. Lane filled the place. The early part of the session was devoted to the reading of minutes, appointment of the nominating committee and the reading of the secretary's report, which was presented by President Reed and included his report as well. It showed two new locals added during the year and 77 additional members, making a total of 334. The membership has almost doubled in two years. The report called attention to the importance of the apprentice question and the place of the foremen in his education. A plea was made for more general support of the association and its benefits were outlined. The financial statement showed a healthy condition of affairs.

Reports were received from a number of local associations, though several were not represented.

The feature of chief interest in the meeting was brought up by the reading of a communication from Secretary F. C. Everitt, recalling the object of the organization, as stated in the constitution to be "a strictly educational" one. Some instances of labor antagonism, he stated, had developed, and the idea that the association was involved in this sort of work had been spread by recent publications in *The Review* of the National Founders' Association and *The Iron Molders' Journal*. He suggested some action in this connection.

A motion that this communication be laid on the table was defeated, after the president had stated that it would be unwise to sidetrack the issue. Mr. Murphy then moved that the report be accepted and that a committee be appointed to consider the problem. This was carried and Messrs. Williams, McMakin and McKenzie were appointed. After a meeting of some length, this committee reported a set of resolutions, which did not prove entirely satisfactory, and a substitute resolution was adopted, as follows:

"Whereas, there has been published in various journals that the National Founders' Association had gained or was gaining control over the Associated Foundry Foremen for the purpose of using this association in its conflict with the iron molders' union. And

"Whereas, in accordance with our constitution such a course would conflict with the principal object of our existence. And

"Whereas, there is nothing in our constitution to prevent any of our members as individuals so desiring to join a local foremen's club, organized for the purpose of aiding the objects of the N. F. A. Therefore, be it

"Resolved, that we emphatically confirm Article 1, Section 2, of our constitution, which says: 'The object of this association shall be *solely educational*,' and further, be it

"Resolved, that any local organization forming a part of this association which violates Article 1, Section 2, of our constitution, shall be adjudged in bad standing with the association, and thereby forfeit its charter, as per article 5, section 4, of the by-laws. And further be it

"Resolved, that a copy of these resolutions be forwarded to every organization and publication interested."

The association was addressed briefly by President West, of the American Foundrymen's Association, who commented on the number of foundry foremen interested in educational matters, by Dr. Moldenke, who reviewed the progress of education in the molding industry, by Henry M. Lane, who told of the convention's plans and prospects and by others.

Officers were chosen, as follows: Hugh McPhee, of Bridgeport, Conn., president; Hugh McKenzie, of Cleveland, first vice president; A. T. Wil-

liams, of Philadelphia, second vice president; F. C. Everitt, of Trenton, N. J., secretary-treasurer.

Meeting of the American Foundrymen's Association.

The eleventh convention of the American Foundrymen's Association opened in Cleveland, Tuesday morning, June 5, with a record breaking attendance for the first day. The meeting was held in the large Central Armory, chairs being arranged for those in attendance at the session of the convention in the central section of the large auditorium, while on all sides were exhibits of foundry supplies, constituting the most elaborate display ever made at a convention. While the response of so many dealers in foundry supplies was indeed pleasing, there was necessarily considerable confusion at the opening session, as the placing of exhibits had not been completed, and the committee appointed by the association to attempt to suppress noise had all that it could do.

The address of welcome to the city of Cleveland was delivered by Mr. N. S. Calhoun, of the Johnson & Jennings Co., and was followed by the address of the president, Thomas D. West, on "The Need of Benefit of a Practical Education." Mr. West was rather severe in his criticisms of some tendencies in modern education which, in his opinion, are far from practical. In conclusion he said:

"This address may be considered in the light of an appeal for a reform in matters of education and home training to create practical beings and good workers, to an association that, together with a few others, stand foremost in doing what can be most rightly commended by civilization. We have had martyrs in the past who have given up their lives for the good of others, and we have today men who are advocating reforms that would exact great sacrifice on the part of others. What greater sacrifice, however, and liberality of spirit can be seen in present times than to perceive members of a body like the American Foundrymen's Association giving gratuitously to the world their trade secrets and experiences, as well as original researches, obtained at great labor, and often great expense, which but a few years ago, comparatively speaking, all men would have held in their strong boxes.

"We have socialism and other 'isms' striving for public support, but few have discerned or at least given to this and other modern kindred associations and its workers credit for the putting aside of selfishness, the gratutious distribution of information, and the creating of co-operation among rivals in trade beneficial to the masses as well as themselves.

"It is hoped that this aggression on your time in not dealing more directly with questions of sand and iron, will be considered equally as beneficial, and may help to call public attention to a grave matter covering the welfare of the nation.

"There are over five thousand proprietors of foundries and as many more superintendents and foremen combined with the allied interests, such as chemists, patternmakers and supply men, that should take great interest in our association's work. There are many who naturally do take a great interest, and those who do not would doubtless do so were they to attend one of our meetings or take the time to investigate the good work that has been accomplished by our association and members in helping each other to advance knowledge and skill in the art of founding.

"We are a body of men who have had our struggles the same as all pioneers in striving for advancement, and have among us workers who have been untiring in their labors to aid the good cause. When the work of our association is closely analyzed and the consequences realized, we are forced to concede that it has been of the highest educational character, doing commendable labor that should be assisted by all those connected with the foundry business.

"While much good has been accomplished by our association, there is still greater work before us, but to do this properly we should have a much larger membership. It is to be hoped that this 'Cleveland Convention' will result in giving an impetus in this direction. In justice to ourselves we cannot recede; we must enlarge and press forward. Can we say more in soliciting outside craftsmen to join us? The latch string is out, and 'Welcome' is emblazoned above the door, inviting fellow foundrymen to enter and become one of us.

"Education is our association motto, and by making it as practical as possible we can do a great good in helping to make this world grow better. This association and kindred societies will certainly have to labor for more practical methods of instruction if, as a people, we truly desire to develop good skill in our artisans, or to obtain the greatest comfort and happiness for the masses. This is a condition that can and should prevail throughout the civilized world."

The Secretary's Report.

The indefatigable secretary-treasurer, Dr. Moldenke, read his report which was as follows:

In presenting a brief report of the activities of his office during the fiscal year just closed, your secretary begs to state that the affairs of the association are in satisfactory condition, its influence steadily rising, and its usefulness growing greater all the time.

The year has been one of exceptional activity in the foundry, but also so hampered by high priced materials, poor deliveries, and economic troubles, that on the whole few foundrymen look back upon it with satisfaction. We may except only those who have so far specialized their work that the foundry end needs only make part of the profit of the concern. These facts, peculiar as they may seem when taken in connection with the era of prosperity we are in, have been gathered by the voluminous and far extending correspondence, as well as personal interviews during the year. No wonder that the foundry is so sensitive to all kinds of disturbances, and the layman regards pig iron, which is without his knowing it the big item in the foundryman's bills, as the best barometer of trade conditions.

As a result of the reduction in the annual dues last year, the association has slightly increased its membership, having exactly three hundred members at the present time. Very strenuous efforts were made to obtain new members, both by correspondence, and personal interview. The association is well known in all parts of the world. Letters come from everywhere asking information, advice, and even plans and estimates for new foundry ventures. Everything possible is done to oblige the correspondents, and wherever possible the difficulties of engaging in new enterprises pointed out, in order to save loss on the one hand, and destructive competition on the other.

Perhaps the best criterion of the value of the association is the fact that other countries are following our methods with profit to themselves. Again, many local associations, organized for a variety of purposes, find it beneficial to discuss foundry problems of a technical nature at their meetings. Thus, the educational feature for which this association stands exclusively is widely recognized, and your secretary is often called upon to assist at these occasions. A new foundrymen's association has been formed on the Pacific coast, and had not the terrible disaster occurred there, we should have had some representatives of this very live part of the country with us today. We hope for renewed prosperity and a vigorous resumption of the industry along the west coast, and trust that we may hold one of our meetings there at no distant date.

The American Foundrymen's Association has been signally recognized by the election of your secretary as an honorary member of the British Foundrymen's Association, and further by his appointment on the national ad-

visory board for testing fuels and structural materials recently created by the president. Its members are on a committee now engaged in testing coke for the government in St. Louis, the plant which we expect to see a part of the magnificent institution in Pittsburg founded by Andrew Carnegie. Furthermore, our members are now at work in formulating standard specifications for foundry coke, in connection with the American Society for Testing Materials. Thus our activity is ever extending, and for the benefit of our industry and the world in general. May we not hope for better support on the part of the foundrymen of the country?

EXHIBIT OF THE ARCADE MANUFACTURING CO.

The government, through its bureau of standards, has now formally taken over our standardizing bureau, thus closing a chapter in our life which has proven of great value to scientific founding as well as the iron laboratory. To our president, Mr. West, is due the credit for its inception and nearly all the labor of maintenance. The Case School, where we meet once at this convention, through its Professor Smith, also has contributed largely to the success of this undertaking, now well known throughout the civilized world.

With the taking over by the government of this work, it will be enlarged to include the steel industry, and possibly go into further branches of interest to foundrymen in general We hope for a wide field and all possible success in this direction.

Considerable progress has been made along the line of trade schools during the year. Our association is not in position to finance any such undertaking. It can but recommend and urge the need of these public improvements. Others are taking up the question, and are better able to carry it through. We rejoice with them that education is thus making headway, and we need not fear European competition quite so seriously as formerly. Let the good

work go on, however, it satisfies our pride to have done the preliminary labor.

We have again to thank THE FOUNDRY for the courtesy of printing our Transactions under an arrangement which gives them to us far below what it would cost us to handle the problem. We trust that this disinterested spirit will be duly rewarded in other directions.

The receipts and expenses for the fiscal year, are as follows:

Received for Dues, etc.	$1,045.18
Standardizing Bureau	495.72
Total	$1,540.90
Disbursed for Salaries	$ 894.62
Printing	92.02
Transactions	154.25
Postage	233.00
Sundries	23.30
Total	$1,397.19

leaving a balance in the treasury of $143.71.

All of which is respectfully submitted.

RICHARD MOLDENKE,
Secretary-Treasurer.

Reading of Papers.

The report of the committee on man, Pittsburg, was submitted, the report being as follows:

Report on Trade Schools.

In reference to the foundry department in the Carnegie Technical Schools I would say the work so far as I have been able to learn has been very successful. The engineering student is the one who derives the greatest benefit this year. Each one of the 120 students goes into the foundry each week and gets the practical side; they not only get the theory but are taught to do the real work. Aside from the best manner of putting work on the floor, they are taught the best practical way and consequently that must be the best commercial way.

They have a 42-inch cupola, the most modern equipped, and an electrical elevator to charging floor. These young men attend to the manipulation of the machinery; they also have the care of the cupola, the charging, the running off of the heats, as well as the pouring of the iron, and the care of the core oven. This gives them an idea in their early training of how the present methods are conducted, and through their ingenuity and skill they will become proficient designers, so as to make work more advantageous in the foundry in the future.

In the evening course for the trade, where only molders were taken, the advantages that these young men have had are very beneficial; they took the apprentice molder and aside from giving him the advanced work on the floor, they taught him mathematics and mechanical drawing; this you see, would not only enliven his mentality but fit him practically to read the drawings, calculate the weight of castings and the setting of cores; they also taught these young men the lining of the cupola, the charging, and the different mixes requisite for a certain kind of casting, and they laid considerable stress on vents as well as consistency of core mixes and sands.

Next year, as I understand it, they hope to start their regular evening class for advanced foundrymen; that is to say, they will have lectures on the foundrying of metals, care of the cupolas through actual demonstration; they will also give a course in chemistry to these men—the chemistry of iron and steel, the chemistry and mixes of iron, to tell what the mixing of the iron constitutes; i. e., carbon, silicon, sulphur, manganese, and phosphorus. These tests will be made in such a manner as to make them thoroughly practical, and the castings will be tested for their ability to resist transverse, tensile, crushing, and impact blows or strains which will include tenacity, elasticity, and toughness. These tests will be made in the laboratory upon testing machines; and the chemistry of sands will also be taken up by this class of men; they will get a certain amount of mathematics and drawing.

They have not been able to start in this department in their day school

as yet, but they hope to, just as soon as more buildings are completed and they have sufficient room.

If this school keeps up what it has started, we have no reason to believe but what this association will be greatly benefited and we trust that Director Hamerschlag will be able to carry out what he has so expressed to us: To make better foundrymen, make better molders, and to give the foundrymen what is their just due in the commercial world.

SOME CHISHOLM & MOORE HOISTS.

The following papers were then read: "The National Bureau of Standards and Its Work," by Director Stratton, Washington, D. C., and "Influence of Different Ore Mixtures on the Resultant Pig Iron, from the Standpoint of the Foundrymen," by General Manager W. K. Barrows, Shenango Furnace, Sharpsville, Pa. In the absence of Mr. Barrows, who was unable to be present, his paper was read by Frank L. Crobaugh, Cleveland.

Tuesday Afternoon's Session.

The session Tuesday afternoon was held in the hall on the second story to avoid the noise of the first floor. Kenneth Falconer, of Montreal, read a paper on "Uniform Practice in Foundry Cost Finding" and it was decided to appoint a committee of five to consider the advisability of appointing another committee to take action on cost keeping.

"Good Molders—Why Are They Scarce?" was the subject of a paper by U. S. McQuillan, of South Norwalk, Conn. E. H. Williams, of the Enterprise Foundry Co., Philadelphia, discussed the paper briefly, making a strong plea for the promotion of temperance among molders and urging that the union co-operate with the employes in this cause. He severely criticized the union for not demanding higher character of men in its membership.

E. H. Mumford, of Philadelphia, read a valuable paper on "Recent Methods of Machine Molding" and Dr. Moldenke described the foundry tests of coke made at the United States fuel testing plant in St. Louis. The paper was briefly discussed.

Wednesday Morning Session.

The third session of the convention was called to order in the Central Armory about 10:30. The first paper read was by E. M. Taylor, of Boston, and was entitled "Correct Application of True Burden to Iron Costs." In the absence of Mr. Taylor the paper was read by Mr. T. E. Crawford of the Library Bureau, Boston. A paper entitled "The Electric Crane in the Foundry" by Harry Sawyer, was read by the title only.

Following Mr. Sawyer's paper Mr. W. H. Parry presented his paper entitled "Dark Secrets in Foundry Practice." Mr. Parry is well known as a practical patternmaker and discussed

problems of the foundry from the standpoint of an outsider. He incidentally described the use of diamonds for cutting tools, the diamond being inserted in a steel holder and used as a lathe tool. While the cost of the diamond was much higher than that of a steel tool, the saving in time of sharpening and in wear more than compensated for the extra first expense. Mr. J. F. Webb inquired as to the cost of using diamonds for cutting tools and Mr. Parry replied that it was about $8.00 to $12.00 per carat. The stones, however, did not need to be sharpened once in six months. The method of preparing the tool was to make a hole in the steel holder in which the diamond was loosely fitted, and then brass solder was poured around it. The stone was sometimes ground before being placed in the holder and sometimes afterwards. Diamond dust was used for grinding and cost from $6.00 to $8.00 per carat.

Mr. James F. Webb next presented his paper on "Multiple Molds," on which there was no discussion. Following Mr. Webb's paper Mr. Ralph H. West read a paper entitled "Comparative Design and Working of Air Furnaces."

President West suggested that, as the paper was of great importance and the amount of time so limited, discussion be postponed until the next session, and then called upon Mr. N. W. Shed to read his paper entitled "Foundry Fluxes." The paper was discussed by a number of gentlemen, the first being Mr. G. M. Thrasher Jr., chemist of Western Tube Co., Kewanee, Ill. Mr. Thrasher described the conditions under which a cupola at the Western Tube Co. was run for eleven hours per day. The flux used was composed of 35 pounds of limestone and 15 pounds of fluorspar to each ton of iron. The amount of coke used was 300 pounds per ton of iron. They found that limestone alone was not adapted to long heats, such as the above, and that the fluorspar was necessary.

Mr. J. F. Webb told of the troubles of a foundryman who charged, in a 54-inch cupola, 7,000 pounds of iron to 1,800 pounds of coke. After the first couple of tons of iron came down it ran cold and Mr. Webb inquired the reason. Mr. Shed, the author of the paper, said that he thought that too much iron was used for the amount of coke charged, and that not over 5,000 pounds should be used with that amount of coke. Dr. Moldenke agreed with Mr. Shed that the amount of iron was too great, and said that not over 6,000 pounds should be charged.

EXHIBIT OF THOMAS W. PANGBORN CO.

Mr. A. M. Loudon told of his experiences with the "Jumbo" cupola at Port Chester, N. Y., which ran con-

tinuously from 11 o'clock in the morning to 5 o'clock in the evening. Buggy ladles were used and the cupola was tapped from two holes alternately. The slag ran continuously. At 2 p. m. they stopped pouring the soil pipe fittings and went on stove plate. A trolley system was used for this work and there was a continuous line of men obtaining metal from the cupola.

Wednesday Afternoon.

In the afternoon of Wednesday the members and guests took cars at the Hollenden at 1 o'clock, which conveyed them first to the plant of the Brown-Hoisting Machinery Co., and then to that of the Welman-Seaver-Morgan Co., and the Electric Controller & Supply Co. They were entertained at these works, after which the

BERKSHIRE MOLDING MACHINES AT FOUNDRYMEN'S CONVENTION.

The flux used under these conditions was 60 pounds of limestone to the ton. They found that a charge of 7,500 pounds of iron gave the best results. Experiments had been tried from time to time in reducing the amount of flux and it had sometimes been brought down as low as 45 pounds of limestone to the ton. Under these conditions, however, the holes almost became stopped up and it was necessary to increase the charge of limestone at once in order to remedy matters. They had never used a flux on the first two charges of iron.

street cars conveyed them to the Case School of Applied Science, where a session was held in the lecture hall of the Electricity building. Prof. C. H. Benjamin, of Case School, gave an illustrated lecture, describing the tests which had been conducted by him on the strength of cast iron during the past ten years.

These tests consisted in the subjecting of cylinders to hydraulic pressure until they burst; the subjecting of plates to hydraulic pressure and to concentrated loads at one point; the testing to destruction of various cast

iron beam sections; and the testing to destruction of cast iron fly wheels and pulleys of various forms.

The lecture was illustrated with lantern slides and Prof. Benjamin pointed out numerous things which had been learned in the course of experiments. For instance, he found that in making a cylinder with flanges heavy enough to provide the requisite strength, blow holes would develop at the junction of the flange and cylinder. These weakened it so that the cylinder always failed, when the flange was to any great degree heavier than the cylinder wall, around the circumference of the cylinder immediately below the flange. In the course of the experiments he developed a cylinder in which both wall and flanges were of uniform thickness, the requisite strength being provided by ribs joining the flange and the cylinder. These cylinders on testing failed in the manner that they theoreticaly should:

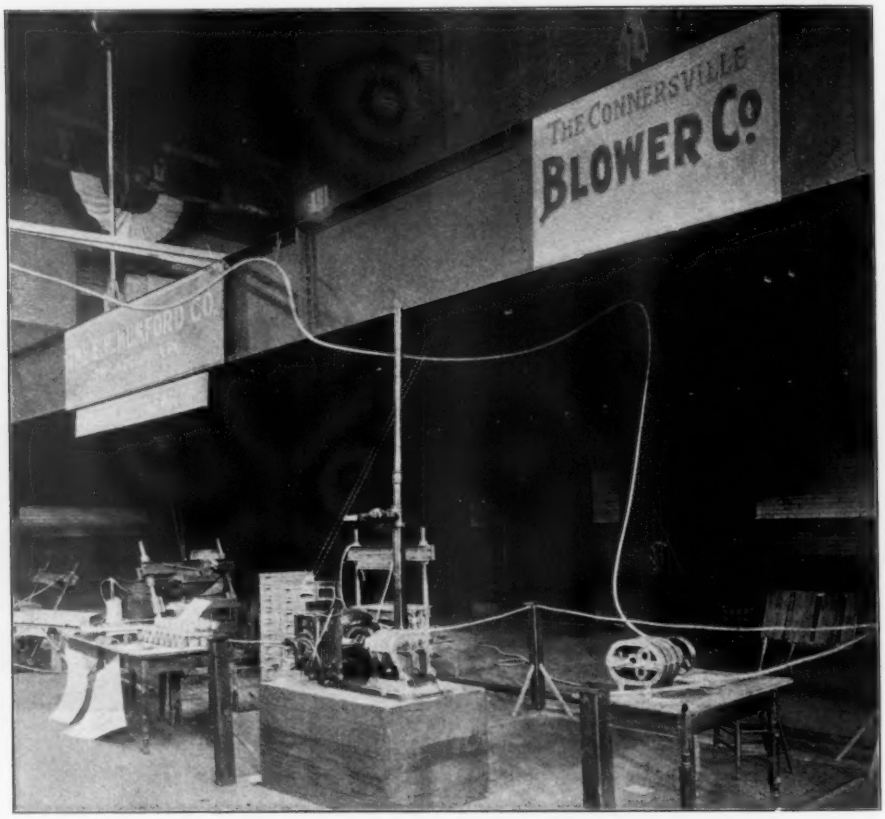
THE ELECTRIC CONTROLLER & SUPPLY CO.'S EXHIBIT.

the tooth always failed on a line parallel to the direction of the applied pressure. The strongest form of tooth was found by these experiments, to be the involute rack tooth. In general the involute tooth was much stronger than the epicycloidal.

The most interesting series of experiments conducted by the professor was the testing of wheels and pulleys to destruction. The pulleys were placed in a steel casing and driven by a steam turbine up to any necessary speed for breaking. The terrific effects of the bursting fly wheel were

Another interesting experiment carried on by Prof. Benjamin was the examination of breaking strength of gear teeth. The gear tooth was placed in a testing machine and broken by applied pressure. It was found that the breaking strength was very close to that calculated by formulae, and that namely, in a straight line parallel to the axis.

illustrated by a photograph of the testing apparatus after it had been demolished by a particularly heavy wheel. The casing was constructed of 1¼-inch boiler plate strongly bolted, with a lining of 12-inch oak blocks. The bursting fly wheel completely demolished the casing, throwing the upper half something over 150 feet away and another portion of it on the roof of one of the buildings. The 1¼-inch boiler plate had broken clean off by the impact.



EXHIBITS OF THE E. H. MUMFORD CO. AND THE CONNERSVILLE BLOWER CO.

At the conclusion of the lecture the society tendered a vote of thanks to Prof. Benjamin. In the evening the members and guests of the society visited Luna park, one of the amusement places of Cleveland, in a body.

Thursday Morning Session.

The concluding session of the meeting was held Thursday morning in the course of a boat ride to Lorain, O. About 450 members and guests went aboard the steamer, "City of the Straits," at 9 o'clock Thursday morning and were conveyed to the works of the National Tube Co. at Lorain, 27 miles distant. During the trip, a meeting was called to order in the saloon of the vessel, and Mr. George M. Loudon read a paper entitled "Core Mixtures and Compounds." This paper dealt with 18 tests made by Mr. Loudon on cores made of various proportions of sand and compound, and with a number of different binders and compounds. Mr. Loudon's conclusions were interesting, as they gave the best proportions and binders for use in cores for different services and of different sizes. There was no discussion on the paper. Dr. Moldenke then

moved that all the other papers submitted at the convention be read by title and the discussion dispensed with. This was agreed to and the convention proceeded to the transaction of general business.

The first business was the election of officers. The nominating committee reported the following nominations for officers to serve for the year 1906-1907:

THE TABOR MFG. CO. AND THE CHICAGO PNEUMATIC TOOL CO.

President, W. H. McFadden, Mackintosh, Hemphill & Co., Pittsburg.

Vice president, first division, New England, C. J. Cayley, Russell & Erwin Mfg. Co., New Britain, Conn.

Vice president, second division, New York and New Jersey, John W. Burr, Brook & Houston Co., Brooklyn, New York.

Vice president, third division, Pennsylvania, Stanley C. Flagg Jr., Philadelphia.

Vice president, fourth division, Ohio and Illinois, J. H. Whiting, Whiting Foundry Equipment Co., Chicago.

Vice president, fifth division, Michigan, W. J. Keep, Michigan Stove Co., Detroit.

Vice president, Sixth division, Wisconsin, Thomas J. Sherriffs, Sherriffs Mfg. Co., Milwaukee.

Vice president, seventh division, the South, J. B. Golden, Golden Foundry & Machine Co., Columbus, Ga.

Vice president, eighth division, Canada, L. L. Anthes, Toronto Foundry & Machine Co., Ltd., Toronto, Ont.

Secretary-Treasurer Richard Moldenke, Watchung, N. J.

The nominating committee recommended that all section officers be appointed by the executive board of the association. On motion, the report of the committee was received and the secretary instructed to cast one ballot for all nominees who were then declared elected.

Mr. H. M. Lane then moved that the organization committee of the American Foundrymen's Supply Association, which was formed at this convention, as related in another column, be made a supplementary committee of

the American Foundrymen's Association, and this motion also was adopted.

Mr. J. G. Seaman, of Pittsburg, then stated that it had been the custom of the society to elect the retiring president to honorary membership in the association, and he therefore moved that Mr. Thomas D. West be so elected. The motion was carried by acclamation.

Dr. Moldenke spoke of the growth of the brass foundry business in the country, and stated that the need for an association of brass foundrymen was becoming greater each year, that while the American Foundrymen's Association welcomed all men engaged in the foundry business, he thought that the work of the brass founders could best be carried on by an organization devoted entirely to that purpose. He, therefore, moved that a committee be appointed to consider the formation of an American Brass Founders' Association with instructions to report at the next convention. The motion was carried, and a committee consisting of Mr. C. J. Cayley and Dr. Moldenke was appointed.

Dr. Moldenke also moved that a committee be appointed with Mr. J. S. Webb as chairman to study the use of nickel in cast iron and report at the next convention.

Mr. J. G. Seaman arose to express the appreciation of the society for the work of Dr. Moldenke in improving the organization and membership of the association, and in raising it to the high plane which it now occupies. He stated that the present position of the society was almost solely due to the doctor's work, and that he had been untiring in his efforts. He therefore moved a vote of thanks to the doctor. The motion was unanimously carried by a rising vote.

THE GOLDSCHMIDT THERMIT CO.'S EXHIBIT.

Dr. Moldenke responded in a few well chosen words, in which he expressed his appreciation of the spirit manifested toward him by the association. He stated that the American Foundrymen's Association was his best work, and that he thoroughly enjoyed working for it. For the past 10 or 15 years, he had devoted his entire time to it and had hardly spent

an evening in pleasure with his family. It gratified him exceedingly to learn that the society appreciated what little he had been able to do for it.

Mr. A. D. Belden, of the United States geological survey, then addressed the association briefly, and described the coke making experiments at the St. Louis coal testing plant. He stated that little or no investigation had been carried on regarding the subject of coke making.

EXHIBIT OF THE WHITE TOOL & SUPPLY CO. AND THE CRESCENT MACHINERY CO.

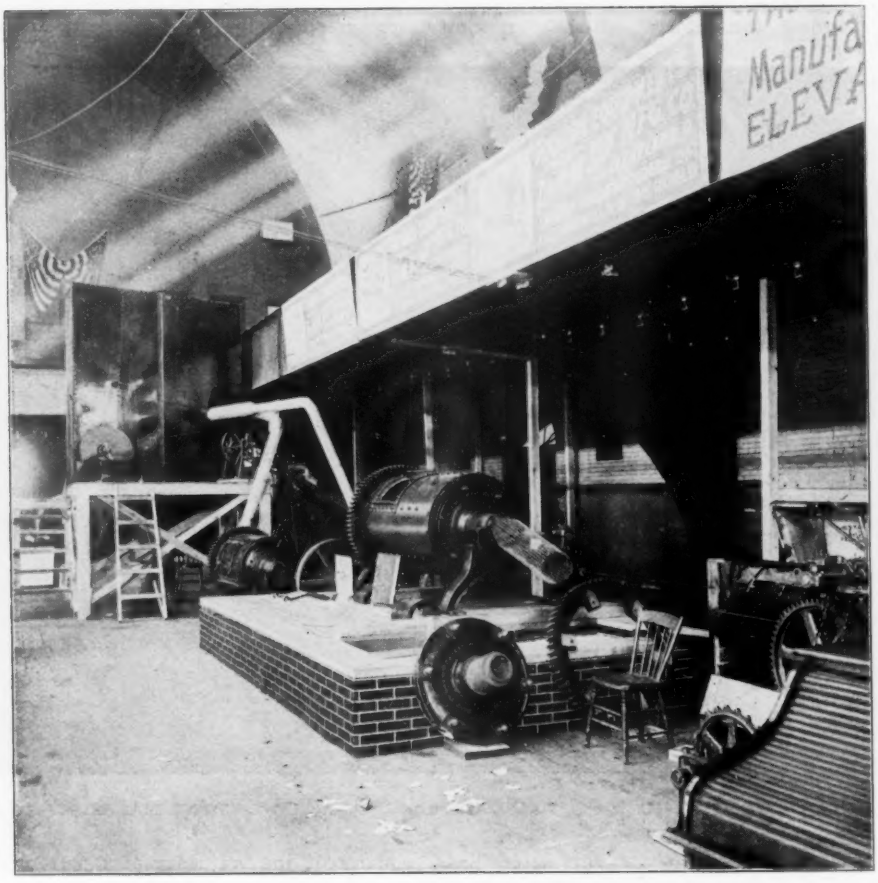
This was due to the fact that nature had provided a splendid grade of coking coal at Connellsville, which requires little or no attention while it was being reduced to coke. The present investigation was being carried on to determine the best methods of manufacturing foundry coke from the many bituminous fields of the United States. In the near future, a partial report will be published of the progress made, and later on, a complete report of the work done will be forthcoming.

An invitation was received from the Philadelphia Foundrymen's Association to hold the next convention in Philadelphia. As the selection of the place of meeting is vested in the executive board, the association passed a resolution recommending that the executive board select Philadelphia as the next place of meeting.

Mr. Field offered a motion tendering votes of thanks to the retiring officers of the association for the efficient administration which they had given it; to the authors of the various papers presented at the meeting; to the local committee for the splendid entertainment provided, mentioning especially in this connection, Mr. H. M. Lane, who has been untiring in his efforts and to whom the success of the meeting and the exhibits was largely due; and to the Philadelphia Foundrymen's Association for its invitation for 1907. The motion was unanimously carried.

Mr. Kenneth Falconer, speaking on a uniform method of cost finding, embodied the substance of his report in a motion to submit to a committee of two or three,

which should report at the next convention, the question of a method of uniform cost finding applicable to the foundry business, and that members be requested to submit to this committee any suggestions which might be available. The motion was carried and the meeting then adjourned.



CLEANING ROOM EQUIPMENT SHOWN BY W. W. SLY MFG. CO.

At the close of the meeting, luncheon was served on board of the boat, and by the time it was over, the party had arrived at Lorain. The association disembarked and went through a portion of the plant of the National Tube Works, visiting the Hulett electric ore unloaders, the blast furnaces, power plant and foundry. About two hours were spent on shore and the party then re-embarked and were brought back to Cleveland, reaching town at about 4:30. During the return trip, a meeting of the newly organized American Foundrymen's Supply Association was held, as described on another page of this issue. On its arrival in Cleveland, the association and its guests proceeded to the steps of the Chamber of Commerce where the photograph shown in connection with this report was taken.

AMERICAN FOUNDRYMEN'S SUPPLY ASSOCIATION.

In January, 1906, a group of foundry supply dealers in Cleveland met to discuss the advisability of holding an exhibition of foundry supplies and equipment in connection with the American

Foundrymen's Association convention in Cleveland, June 5-7. This resulted in the formation of what was known as the A. F. A. Exhibit Association, a local organization formed to conduct the exhibition in Cleveland.

J. S. Smith, of the J. D. Smith Foundry Supply Co., was elected president, and H. M. Lane, editor of THE FOUNDRY, secretary and treasurer. To provide funds for carrying out the preliminary work and to insure the work of the exhibit, the 11 members of the original association each contributed toward a guarantee fund which was paid in at once. Several meetings were held, the matter discussed thoroughly, and it was decided to rent the Central Armory, which is 120 x 207 feet, and to hold the exhibit and the convention in the same building. Letters were sent to all supply dealers throughout the country, and a large number responded heartily.

The exhibit, as carried out by the A. F. A. Exhibit Association proved very successful indeed, and on the second day of the exhibit, June 6, some of the exhibitors, together with a few supply men, held a meeting at the armory to consider the advisability of a permanent foundry supply association for the purpose of financing the entertainment features of the annual conventions, and also for the purpose of carrying on an exhibit of foundry supplies and equipment each year in connection with the convention. The exhibit has proven to be such a drawing card at Cleveland that an unanimous opinion was expressed in favor of such an association. H. M. Lane was chosen temporary chairman, and first gave a statement of the history of the

THE FALLS RIVET & MACHINE CO.
HOLLAND LINSEED OIL Co's
FALLS RIVET & MACHINE CO.
THESE CORES ARE MADE FROM
HOLLAND CORE OIL
MIXED AT 45 TO 1.

THE FALLS RIVET & MACHINE CO. AND THE HOLLAND LINSEED OIL CO.

Cleveland exhibit. The organization committee was then appointed to nominate officers and outline the business of the organization. This committee consisted of C. T. Smith, of the Chicago Pneumatic Tool Co., Cleveland, O., S. T. Johnson, of the Obermayer Co., Chicago, Ill., U. E. Kanavel, of the Interstate Sand Co., Cleveland, O., P. C. White, of the White Tool Supply Co., of Cleveland, and S. W. Hubbard, of Rogers, Brown & Co., Cleveland.

EXHIBIT OF THE WHITING FOUNDRY EQUIPMENT CO.

Some of the advantages to be derived from such an organization, as brought out in the discussion, were as follows:

The holding of an exhibit in connection with the convention would serve as a drawing card and make the conventions much more popular.

The fact that the supply men would look after the financing of all the entertainment features of the convention would relieve the A. F. A. officers of such work and leave them free to carry on the regular work for which the association was formed, namely: the advancement of foundry practice by the reading and discussion of papers; in other words, the promulgation of foundry literature and the education of foundrymen.

The forming of a regular supply association similar to the Master Mechanics, Master Blacksmiths and Master Car Builders, etc., would place all of the supply men on an equal footing, so that the expenses would be divided more equitably than has been heretofore possible.

Every convention has had marked examples of the means by which some people "sponge" on their more generous competitors.

By building up both associations, making the membership in each desirable and making the entertainment features exclusively for members, many of these abuses would be avoided.

On the return trip of the members and guests of the association from

Lorain the following day, a meeting of all the supply men on board the boat was called to order in the cabin of the vessel. Mr. Lane was made temporary chairman of the meeting, and briefly explained the business of the proposed association as outlined above for the benefit of those who were not at the preliminary meeting. He then reported that the organization committee had nominated the following officers for the association: President, S. T. Johnson, Obermayer Co., Chicago; first vice president, E. H. Mumford, E. H. Mumford Co., Philadelphia; second vice president, E. A. Kebler, Matthew Addy & Co., Pittsburg, secretary-treasurer, H. M. Lane, THE FOUNDRY. These nominees were unanimously elected to their respective offices, and Mr. Lane then reported that the following committees had been recommended: Committee on constitution—C. T. Smith, U. E. Kanavel and F. C. White. Finance committee—H. E. Pridmore, John Hill, U. E. Kanavel, C. T. Smith, Jas. Darragh. Committee on entertainment—H. Evans, Wilfred Lewis, Geo. Borden, Chicago Pneumatic Tool Co., Philadelphia; John S. Wilberham, of the Baker Blower Co., Philadelphia; H. E. Mills, of the Syracuse Oil Co., Syracuse, N. Y.

These committees were all confirmed by the meeting and the president then called upon various gentlemen present to address the meeting and give their ideas upon the formation of the association and its objects. President Johnson first spoke briefly as to what was to be accomplished by the association, saying in effect what has already been outlined above.

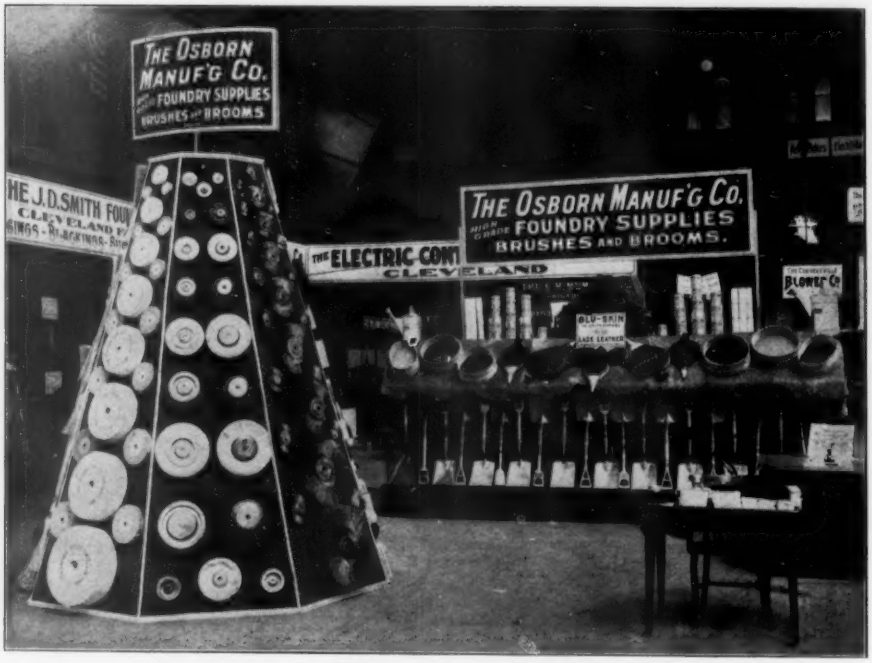
EXHIBIT OF THE ATLAS CAR & MFG. CO.

Dr. Moldenke then stated that such an association had long been needed as the convention sometimes proved a great burden to the local committee and that it necessarily detracted from the real object of the association.

President elect McFadden of the American Foundrymen's Association, spoke in a similar vein, stating that the new administration expected to accom-

plish great things now that the co-operation of the supply men was assured.

Mr. Johnson called on Mr. John A. Penton, of the Penton Publishing Co., for his ideas on the association. Mr. Penton said that 10 years ago he would not have believed it possible that the American Foundrymen's Association could attain the commanding position which it today occupies, and he predicted that in the next 10 years the improvement would be as great and that the increase in membership would keep pace with the improvement. He stated that the difficulty of providing for the entertainment features for a society like that of the American Foundrymen's Association was appreciated only by those who had done so. It was unfair to the association to compel it to bear the burden of a varied and expensive entertainment, the chief benefit of which was reaped by the supply men and he was glad to see that the supply men were now ready to do their part. He suggested for the benefit of the committee on constitution that membership in the Foundrymen's Supply Association should be conditional upon membership in the American Foundrymen's Association, and that no one be allowed to exhibit at a convention of the latter association unless he was a member of the supply men's organization. Mr. Penton then spoke of the educational value to foundrymen of the American Foundrymen's Association, and stated that it would repay the owners of foundries many times over to send their foremen to their conventions and pay their expenses.



THE EXHIBIT OF THE OSBORN MFG. CO.

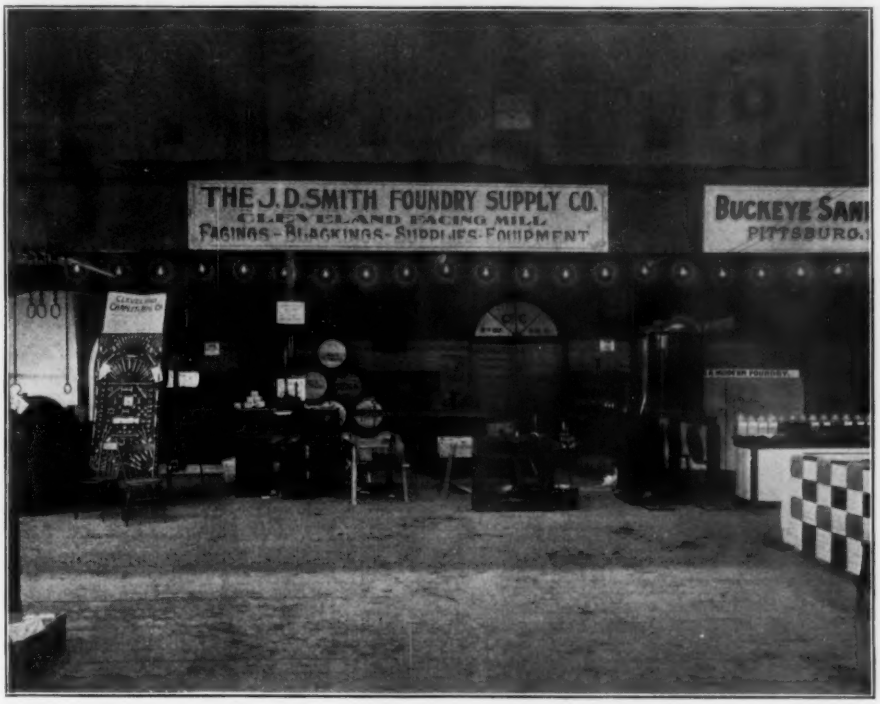
ENTERTAINMENT FEATURES.

The local entertainment committee had prepared an elaborate entertainment program for the visiting guests.

On Tuesday evening there was a theater party at Keith's Theater. The entire ground floor and a portion of the balcony was reserved for the members and their friends, and all reported a good time. Some of the actors found the names of some of the distinguished body before them, and showed that

they were familiar with Tommy West, the president, who was reported as still mixing iron by analysis; with big, tall Ben Fuller from Pittsburg; and with Field, of metallurgical fame.

On Wednesday evening the members and guests went to Luna park in a body, six trolley cars having been engaged for the purpose, and the party headed by a brass band. At the park docks of the National Tube Co., which are three miles up the Black river. The guests were met at the dock by Mr. Masterson and his corps of assistants, who conducted the party about the works. The vessel unloaders were first inspected, where two Hulett unloaders were engaged in removing a cargo from one of the 10,000-ton ore freighters.



THE EXHIBIT OF THE J. D. SMITH FOUNDRY SUPPLY CO.

the various attractions were taken in and the band was everywhere in evidence, being taken over the roller coaster, the "figure eight," the "shute-the-shutes," and all the other attractions visited by the members. Everyone reported a good time and went home tired but happy.

On Thursday the entire party went to Lorain on the steamer City of the Straits. As already stated, a session of the A. F. A. was held on the boat on the way out, and the organization session of the American Foundrymen's Supply Association on the boat on the way back.

At Lorain the party landed at the

The blast furnaces were next visited, and then the foundry. The foundry contains many points of interest. The entire product is used at the various mills owned by the company and consists of three classes of metal; that is, cupola, air furnace, and direct blast furnace metal. The cupola metal is used for ordinary work, the air furnace metal for rolls, and the direct metal for ingot molds.

On Thursday evening the final event of entertainment features took place, in the form of a smoker, which was held in the Central Armory, where the exhibits were arranged. The guests were seated at tables, when

THE EXHIBIT AND CONVENTION ROOM.

they were furnished with their molders' tools, which consisted of a souvenir stein, a corn cob pipe, and a bag of tobacco. The Falls Rivet & Machine Co. also presented each person in attendance with a leather case containing "sample cores," which were stated to have been made on the Wadsworth improved core machine. The cores were all cigar shaped and were made of a very fine quality of tobacco, and hence were put to use by the guests.

Very acceptable music was furnished by Steele's orchestra, which is a local orchestra of eighteen pieces. Amusement was also furnished by a vaudeville entertainment of eight acts.

POURING OFF THE HEAT.

Sandwiches were passed, and lest the members become too dry, liquid refreshment was furnished by pouring off a heat. This was accomplished with the aid of a cupola, furnished by the Whiting Foundry Equipment Co. It was stated that the Whiting Foundry Equipment Co. had occasionally furnished amber-colored liquid refreshments, but never before had it been drawn from a cupola of their make. The cupola was placed on the floor next to the platform, or stage, and was so arranged that the liquid refreshments were tapped from the spout into handladles, and thus carried by the waiters to the various guests at the tables. The steins were filled from the handladles, but as there were some 750 people present, it was found impossible to draw the material from the cupola fast enough, hence one of the steel barrels furnished by the Cleveland Wire Spring Co. was pressed into service. This was mounted on a truck, so that it could be carried from place to place, was filled with beer, and trucked down to the middle of the room. The handladles were then filled by dipping from the barrel.

The molders' tools were distributed to the members from wheel-barrows furnished by the J. D. Smith Foundry Supply Co., and tote boxes furnished by the Cleveland Wire Spring Co.

Considerable amusement was furnished by the local committee passing a number of cigars containing concealed springs, which let go after the cigar had burned a certain distance and scattered the tobacco.

The assemblage broke up at 10:30, everybody saying that the convention had been the most successful and enjoyable in the history of the Association.

The Exhibition.

When the first arrangements were made for the convention, an association was formed for the purpose of conducting an exhibition of foundry supplies, as explained in the report of the American Foundrymen's Supply Association.

When the convention opened there were exhibits from 42 firms. Some of the exhibits were composite exhibits of two or more firms. The total weight of the machinery and supplies exhibited was over 150 tons, and an idea of the work connected with the exhibit can be gained from the fact that this entire mass of material was moved into the armory in two days and set up and running when the convention opened. After three days of exhibit it was all torn out and reshipped in two days. Power for the exhibit was furnished by a 55-horsepower gas engine, installed by the Bruce-Meriam-Abbott Co., Cleveland, O., belted on one side to a 2-inch line shaft 90 feet in length furnishing power to the various power exhibits, and on the other to an air compressor, fur-

nished by the Chicago Pneumatic Tool Co. The air lines running the various exhibits required over 400 lineal feet of piping to reach the different exhibits. There were also over 300 feet of gas lines laid to reach various exhibits. in addition to the power furnished by the gas engine, three of the exhibits were driven by electric motors requiring an aggregate of 25 horsepower. The Electric Controller & Supply Co. also used a heavy current for its lifting magnets.

EXHIBIT OF THE B. F. STURTEVANT CO. AND THE REPUBLIC BELTING & SUPPLY CO.

The various exhibits are described in greater detail below:

The Exhibits.

The Cleveland Wire Spring Co., of Cleveland, O., had a very interesting exhibit of steel foundry barrels and metal tote boxes, for use in foundries and other manufacturing establishments. These barrels are only about 50 per cent heavier than wooden barrels and are many times stronger and their life very much longer. They will absolutely pay for themselves in a short time in the saving of broken barrels and particularly in the saving due to the fact that when these barrels are used a certain aggravating occurrence never take place. In other words, all who have used wooden barrels are familiar with the breakdown that often occurs in the gangway and sometimes takes three men to clean up, and in the meantime blocks all passage in that department. Metal barrels do not break down. Some barrels are also provided with trunnions and a special truck arranged for handling them.

THE FOUNDRY exhibit was used large-

ly as a bureau of information and headquarters for the many friends of THE FOUNDRY. Copies of the different papers published by the Penton Publishing Co., and also a number of practical books on foundry practice were shown and subscriptions taken for the same. For the convenience of the visitors a stenographer was present who was ready to write letters for any one having business to transact.

The Western Foundry Supply Co., East St. Louis, Ill., occupied the adjoining space. This exhibit consisted of a number of glass jars containing various products, such as metallic cement, parting compound, various facing compounds, ground ferro-silicon, ferro-manganese, etc. The company also distributed souvenir bags of ferro-manganese.

The American Sand Co., Columbus, O., had an exhibit consisting of a series of sand bins containing various grades of molding sand, before which were arranged tables containing jars of molding sand and silica sand. One of the features of the exhibit was a number of cartoons posted on the railing in front of the space.

The B. F. Sturtevant Co., of Boston, Mass., had a number of features in its exhibit which were of especial interest. At the front of the exhibit was a sectional model of the latest patent of high pressure blower, manufactured by this company. The model was driven by an electric motor and illustrated very nicely the action of this new type of machine. The exhibit also contained three of the firm's well known centrifugal fan blowers of various sizes. Mr. W. H. Coleman, of the Chicago branch, was in charge, assisted by Mr. S. C. Cutler, who represents the B. F. Sturtevant Co. in Cleveland.

The Republic Belting & Supply Co., of which Mr. S. C. Cutler is vice president, had an exhibit of belting, foundry supplies and Cortland corundum wheels. As Mr. Cutler is connected with both firms, the exhibit was shown in connection with that of the B. F. Sturtevant Co.

Harbison-Walker Refractories Co., Farmers' Bank building, Pittsburg, Pa., displayed some of its blocks and fire brick for lining cupolas.

W. W. Lindsay & Co., Philadelphia, Pa., had an exhibit of chaplets of all classes and gave away a very neat chaplet souvenir in the form of a paper weight.

The Diamond Clamp & Flask Co., Richmond, Ind., had on exhibit a Gartside core machine for making round cores with coned ends, also for making irregular cores, such as pipe bends, etc. The machine is quite unique in its design and construction. The exhibit also contained universal couplings, pattern dowels and other devices manufactured by the company.

The Interstate Sand Co., Cleveland, O., which handles the product of the Ayers Mineral Co., of Zanesville, O., the Ohio Sand Co., of Conneaut, O., of L. K. Brown, Zanesville, O., the Gordon Sand & Gravel Co., Cleveland, O., and the Central Silica Co., of Zanesville, O., had a unique exhibit, including jars containing the different grades of sand handled by the company and advertising matter concerning it. The two most attractive features in the booth, however, were a microscope for the examination of sand and a pair of water coolers for dispensing pure drinking water. This latter feature proved a great attraction on the hot days.

The Berkshire Mfg. Co., Cleveland, O., exhibited two of its automatic molding machines, one being connected up with a revolving sand riddle and used for making molds for a plate of fittings. The other machine was connected with the power and ran idle, so as to show the mechanism. There was also on exhibition a small aluminum model of the machine and a large collection of castings molded upon the Berkshire machines.

The J. D. Smith Foundry Supply Co., Cleveland, O., had a combination exhibit, including facings and other foundry supplies manufactured and handled by the company. A squeezer molding machine made by the firm.

the Battle Creek sand sifter, a new sand sifter made by the Taylor & Boggis Co., brass melting furnaces, and lifts or hoists for pulling pots were also shown. A water tumbler and an exhibit of chaplets made by the Cleveland Chaplet Co. were also shown as was an exhibit of paints and paint materials.

The Buckeye Sand Co., of Pittsburg, had an exhibit of the various grades of molding sand handled by it.

The Wellman-Seaver-Morgan Co., Cleveland, O., had an exhibit of drawings of foundries.

The E. H. Mumford Co., of Philadelphia, exhibited two of the latest improved Mumford molding machines and one of the Rathbone multiple molding machines, and also an exhibit of castings made upon the Rathbone machines.

The Herman Pneumatic Machine Co., of Zelienople, Pa., had on exhibition one of its large pneumatic jarring molding machines, which was in operation. The molds were lifted off by a pneumatic hoist which ran on a trolley overhead, furnished by the Chicago Pneumatic Tool Co., Chicago.

The Electric Controller & Supply Co., Cleveland, had one of the most spectacular exhibits on the floor. This consisted of an electric lifting magnet, of two tons capacity, suspended from a special framework by means of an electric hoist. A couple of tons of pig iron were placed on the floor underneath the magnet, and elevated by it. After they had been raised about six feet, the current was cut off from the magnet and the iron allowed to drop, when the operation was repeated.

The Connersville Blower Co., Connersville, Ind., had on exhibit a sectional blower showing the manner in which the rotators worked and also a small blower driven by an electric motor.

The Thomas W. Pangborn Co., New York city, exhibited the American Diamond sand blast, the exhibit being in charge of J. B. Botham, sand blast engineer.

The Crystal Fluor Spar Mining Co., with headquarters in the American Trust building, Cleveland, O., had on exhibition samples of fluor spar, which sold under the name of Empire foundry flux.

The Goldschmidt Thermit Co., as usual, presented one of the most interesting exhibits in the hall, a detailed description of which would occupy a large amount of space. There were samples cut from welds of various types, made by thermit, and cut through the weld, showing the accuracy of the workmanship. There were clamps and molds for all classes of thermit welds, and illustrations and photographs showing some of the many applications of the thermit. One very interesting feature of the exhibit consisted in a collection of various metals, free from carbon, which were manufactured by the thermit process. Daily demonstrations of the use of thermit were given, including welding, burning on, and other uses. The exhibit was in charge of Mr. A. M. Guenther. Mr. E. Stutz, vice president of the company, was also present at the convention and spent much of his time at the exhibit.

The Tabor Mfg. Co., of Philadelphia, exhibited two pneumatic molding machines, a roll over molding machine and a Taylor-Newbold saw which is of especial interest to steel foundrymen. The roll over machine attracted a large amount of attention.

The Chicago Pneumatic Tool Co. had on exhibition an air compressor which was driven by a gas engine furnished by the Bruce-Meriam-Abbott Co., Cleveland, O., also a collection of pneumatic tools and appliances including hoists, hammers, drills and other pneumatic tools. These were all exhibited in operation.

E. A. Dempwolf & Sons, York, Pa., manufacturers of hydrofluoric acid, had a space to serve as headquarters for the distribution of literature.

The Buckeye Milling Co., of Cleveland, O., had an exhibit of cores made with its Wago dry core compound and

gave away samples of the compound in pound boxes.

The Atlas Car & Mfg. Co., of Cleveland, O., had on exhibition a section of industrial railway with a switch and truck, also a dump car and a turn table.

The Osborne Manufacturing Co. had the space in the center of the hall, directly in front of the main entrance. In the center of this space was arranged an octagonal pyramid, each face of which was covered with a different type of brush. There were hard and soft bristle brushes, wire brushes of all types, both for power and hand use, and in fact, the layman would be bewildered by the array of brushes which the various specialties in the different branches of the business have brought into existence. At one side of the pyramid there was a stand, upon which were exhibited molders' riddles and shovels; also blue-skin belt lacing. This is said to be the toughest and best belt lace leather manufactured anywhere.

William Dobson, manufacturer of molders' tools, of Canastota, N. Y., had a very attractive exhibit, consisting of a hardwood stand supporting columns carrying an elevated shelf. Upon these were arranged a large variety of molders' tools. The tools were all carefully finished, and while none of those present, probably, ever expect to earn their living again with the use of the rammer, trowel and slick, they were, nevertheless, very much interested in the display, and many of them will undoubtedly recommend these tools to their employes in the future. This exhibit was made especially efficient by the fact that Mr. Dobson and his assistant, Mr. L. H. Hough, were always present and ready to answer any number of questions. The souvenir aluminum scale given away at this space was an additional drawing card.

A. Brandau, of Detroit, had on exhibit his well known brand of molders' shoes. The leather in these shoes is treated by a secret process, which renders it to a large extent fire proof. Samples of the leather were introduced into the flame of a candle until the leather twisted and curled, after which it could be straightened out, bent, twisted, or pulled, as though nothing had happened to it. These shoes are especially designed for use in the sand heap and are gaining friends among the molders every year.

MR. GARTSIDE'S NEW CORE MACHINE.

The Monarch Engineering Co., of Baltimore, Md., had on exhibit one of the Monarch furnaces, which, unfortunately, could not be operated in the exhibit hall, as natural gas was not available. The original plan was to operate this furnace and pour off some of the molds made on the molding machines. The next best arrangement was made, which was to install a furnace in the exhibit, which was not in operation, and another at the shop of the Eastern Ohio Gas Co., which was in operation. Many of the visitors were taken to see this latter furnace, and interesting demonstrations of its efficiency made.

The Whiting Foundry Equipment Co., of Harvey, Ill., had on exhibit one of the latest type of 44-inch cupola furnaces. This was arranged with upper and lower tuyeres, slag spout, and all the modern improvements. The cupola was mounted next to the speaker's stand, and as described elsewhere, was used for drawing off the liquid refreshments the night of the smoker. The kegs were arranged back of the speaker's stand and a block tin pipe line laid into the cupola and sharpening stones, grinding wheels, polishing material, belt lacings, and other similar materials.

The Arcade Mfg. Co., of Freeport, Ill., exhibited two of the Arcade "Modern" molding machines. These machines are hand operated and ram both cope and drag at the same time. The exhibit contained a large number of castings made on this machine and molds were made at a very rapid rate. A statement at the exhibit shows that one of the men, shoveling his own sand

THE STANDARD SAND & MACHINE CO. Cleveland, O.
SPECIAL FOUNDRY MIXING, SCREENING,
CONVEYING MACHINERY &c. Also Shippers of all Grades Molding Sand.

EXHIBIT OF THE STANDARD SAND & MACHINE CO.

through an ice box arranged inside of the same. The spout was made up in the ordinary manner, the block tin pipe being concealed in the lining of the spout.

The White Tool & Supply Co., of Cleveland, O., had one of the most attractive displays at the convention. This company is agent for the Crescent Machinery Co., of Leetonia, O., and hence had on exhibit a complete line of patternmaking machinery, including one of the most recent models of the Crescent band saw, a Universal saw table, and a surfacer. The Fox trimmers were also exhibited. In addition there was a complete line of from the heap, has made and poured 275 molds per day of seven hours, using an 11 x 16 flask. These molds required approximately 1,200 pounds of melted iron. In the photograph, unfortunately, one of the machines is almost directly behind the other so that they do not show off to special advantage. One feature of the machine is a very ingenious method which is used for making the necessary match plates. After the two parts of the mold are filled, struck off and rammed, they are rolled over and the pattern drawn up from the mold. The parts are then drawn forward on to an apron, the mold assembled, and the snap flask removed.

The sand for this exhibit was furnished by the Garden City Sand Co., of Chicago, Ill.

The Chisholm & Moore Mfg. Co., of Cleveland, O., occupied the space next to the Arcade Mfg. Co., and displayed five of the well-known Chisholm & Moore chain hoists. The operation of the hoists was also well illustrated by sectional models.

The Detroit Foundry Supply Co., Detroit, Mich., had a space and desk next to that of the Chisholm & Moore Mfg. Co., and had on exhibit its newly patented Galvarim riddle. This is a new departure in riddles. The rim is made of galvanized iron, with the top and bottom beaded over 3-16-inch iron wire. The screen is formed over a wire rim, and held in place by a groove near the bottom of the riddle frame. These screens can be replaced when worn out, thus greatly increasing the life of the riddle. The representatives of this company, Messrs. Crandall, Woodison and Beers, were in constant attendance at the convention, and we presume that the next edition of *The Blast* will contain many interesting features.

SOME OF THE WORK OF THE RATHBONE MULTIPLE MOLDING MACHINE.

The gas engine has recently come into the foundry as a source of power, and every year sees more gas or gasoline engines installed for this purpose. Recognizing this fact, the Exhibit Association was very glad indeed to have on exhibit one of the latest types of gas engines, which was furnished by the Bruce-Meriam-Abbott Co., of Cleveland. The one shown was a 55-horsepower engine and operated an air compressor in the exhibit of the Chicago Pneumatic Tool Co., and a line of shafting 90 feet in length for driving some of the power exhibits. The engines of this type have an ignition at each stroke but the governor regulates the gas used so as to produce a uniform speed with any load.

The W. W. Sly Mfg. Co., Cleveland, makes a specialty of cleaning room equipment and had on exhibit a number of well-known machines of its make. These included a pair of exhaust tumbling mills, connected with a dust arrester of the latest type. A representative of the company went to one of the local foundries and secured a quantity of tumbling mill dust which was put into the tumbling mills, blown into the dust arrester, and the air which came out into the room was perfectly clean, thus showing the efficiency of the device. The statement was made that this air could be blown across the top of a desk without soiling the writing paper. In addition the exhibit contained one of the Sly water cinder mills, with all of the accessory mountings. There was also on exhibit one of the heads for a tumbling mill and one of the gears, showing the workmanship on both.

The Standard Sand & Machine Co., of Cleveland, O., exhibited two types of sand-preparing machinery, one of which was in operation. This company manufactures machines so ar-

ranged that they will make any desired mixture from a number of brands of sand. In this case all the operator has to do is to keep the machine supplied with the various classes and it will mix and temper the material which is required. Sand mixed in this way runs much more uniform than hand-tempered sand and is also much more economical, as a large proportion of old sand or local sand can be used in the mixture. The exhibit also contained a large variety of the molding sands handled by the firm.

George H. Wadsworth, of the Falls Rivet & Machine Co., Cuyahoga Falls, O., has made a specialty of core-room

THE MONARCH ENGINEERING CO.'S EXHIBIT.

equipment, and by far the largest proportion of this exhibit was made up of core-room specialties. The well-known Wadsworth core machine was on exhibit, there being three machines in operation. One was driven by a compressed air motor, one six-inch machine was driven by hand, and a smaller machine by hand. There was also on exhibit a very neat core oven which has recently been designed by Mr. Wadsworth especially for the drying of machine-made cores. The Wadsworth core-coning machine, recently illustrated in these columns, was included in the exhibit, as was also the Wadsworth tumbling barrel. A large number of oil sand cores made upon the Wadsworth machine were shown, including squares, octagons, ovals, and other irregular forms. The cores vary in size from ⅜ of an inch square to ⅞ inch in diameter.

Adjoining the exhibit of the Falls Rivet & Machine Co., was that of the Holland Linseed Oil Co., of Chicago, Ill. Mr. Baumgardner had on exhibit a number of remarkable cores which were made with the Holland core compound. One core was for the interior of a hollow casting used in a steam laundry machine. The core was nearly eight feet in length, 16 inches in width, and 4½ inches in thickness at the center. It was entirely surrounded with metal, with the exception of two small holes at the ends through which the vent was removed. The casting had to stand 80 pounds of steam pressure per square inch. There were a number of other remarkable cores in this exhibit.

Those in Attendance.

Abell, Fred A., Interstate Foundry Co., Cleveland.
Abell, O. J., *The Iron Trade Review*, Cleveland.
Adams, Ezra S., *The Iron Age*, Cleveland.
Adamson, R., The Farrel Machine Co., Ansonia, Conn.
Adams, W. J., S. Obermayer Co., Milwaukee, Wis.
Aikens, M. H., Berkshire Mfg. Co., Cleveland.
Aland, Chas., Jas. B. Clow & Sons, Newcomerstown, Ohio.
Allyne, E. E., Allyne Brass Fdry. Co., Cleveland.
Allyne, A. H., Allyne Brass Fdry. Co., Cleveland.
Ames, Lyman, Columbus Iron & Steel Co., Columbus, Ohio.
Anderson, Axil, Moline Plow Co., Moline, Ill.
Andrews, Russel R., The Vulcan Fdry. Co., Hamilton, Ohio.
Anthes, S. S., Toronto Fdry. Co., Toronto, Ont.
Antisdale, Nelson, Ideal Mfg. Co., Detroit, Mich.
Armstrong, G. H., Matthew Addy & Co., Pittsburg, Pa.
Armstrong, I. H., Oliver Machinery Co., Grand Rapids, Mich.
Arnold, H. C., A. Carpenter & Sons Fdry Co., Providence, R. I.
Atwater, H. R., Osborn Mfg. Co., Cleveland.
Ayers, E. M., The Interstate Sand Co., Zanesville, Ohio.
Backert, A. O., *The Iron Age*, Chicago.
Bair, Adam W., Chicago, Milwaukee & St. Paul Car Wheel Fdry., Milwaukee, Wis.
Baird, N. E., C. E. Mills Oil Co., Syracuse, N. Y.
Baldwin, H. W., T. H. Symington Co., Corning, N. Y.
Baldwin, L. K., The Interstate Fdry Co., Cleveland.
Barker, Fred, Coe Mfg. Co., Painesville, Ohio.
Barnes, T. R., Barnes Mfg. Co., Mansfield, O.
Barr, J. D., Penn. Facing Mill Co., Irwin, Pa.
Barr, W. J., The Interstate Fdry., Cleveland.
Barringer, Robert R., Baltimore Railroad Specialty Co., Corning, N. Y.
Barry, D. J., Buckeye Milling Co., Cleveland.

Bartol, Geo., Gen. Mgr. The Otis Steel Co., Cleveland.
Bates, A. N., Erie Fdry. Co., Erie, Pa.
Battenfeld, Carl, Berkshire Mfg. Co., Cleveland.
Battenfeld, J. N., Berkshire Mfg. Co., Cleveland.
Bauman, J. A., Jones & Laughlin Steel Co., Pittsburg, Pa.
Baumgardner, P. M., Holland Linseed Oil Co., Chicago, Ill.
Beach, Edward W., Manufacturers Fdry Co., Waterbury, Conn.
Beaman, J. W., W. E. Pratt, Joliet, Ill.
Beemer, Miles W., Beacon Fdry & Eng. Co., New York City.
Beers, Wm. R., Detroit Fdry. Supply Co., Detroit, Mich.
Beeson, T. S., The Wm. Tod Co., Youngstown, Ohio.
Bennett, Geo. G., The Bennett Eng. & Steam Specialty Co., Cleveland.
Bennett, H. M., *The Southern Machinist*, Atlanta, Ga.
Berchtold, L. J., Erie Eng. Co., Erie, Pa.
Bergman, Aug., The Ohio Cultivator Co., Bellevue, Ohio.
Bernard, L., Palmers & DeMooy, Cleveland.
Bever, J. J., Otis Steel Co., Cleveland.
Bill, H. L., Dodge Mfg. Co., Mishawaka, Ind.
Bixler, R. E., Buckeye Sand Co., Pittsburg, Pa.
Blanchard, A. S., The Wellman-Seaver-Morgan Co., Cleveland.
Blanchfield, C. O'D., *Industrial World*, Pittsburg, Pa.
Blunt, L. G., The Ferro Machine & Fdry. Co., Cleveland.
Blyth, Robert, Walker-Pratt Mfg. Co., Watertown, Mass.
Bocking, Ferdinand, Seerbrucken, Germany.
Boggis, H. J., Taylor & Boggis, Cleveland.
Bohnard, Wm., The Otis Steel Co., Cleveland.
Botham, J. B., Thos. W. Pangborn Co., New York City.
Boughton, A. L., The Standard Sand & Machine Co., Cleveland.
Boughton, H. E., Standard Sand & Machine Co., Cleveland.
Boughton, W. G., Standard Sand & Machine Co., Cleveland.
Boughton, H. G., Standard Sand & Machine Co., Cleveland.
Bowie, John, Corrigan, McKinney & Co., Cleveland.
Bowler, N. P., Bowler Fdry Co., Cleveland.
Boyd, C. A., Wellman-Seaver-Morgan Co., Cleveland.
Boyd, W., Wellman-Seaver-Morgan Co., Cleveland.
Boyle, James, Buckeye Eng. Co., Salem, Ohio.
Boynton, J. C., Palmers & DeMooy, Cleveland.
Bradley, John A., Akron, Ohio.
Brainard, J. C., Johnston & Jennings Co., Cleveland.
Brainard, S. W., Cleveland.
Brandau, Adam, Mfg. Molders' Shoes, Detroit, Mich.
Brans, Frank, Griswold Mfg. Co., Erie, Pa.
Brant, Wm. J., The Millers Products Co., Pittsburg, Pa.
Brown, Dennis, F. P. Curtiss Co., New Britain, Conn.
Brown, Frank P., Westinghouse Electric Co., Cleveland.
Brown, L. K., Interstate Sand Co., Zanesville, Ohio.
Bruce, W. C., Bruce-Meriam-Abbott Co., Cleveland.
Brunner, Fred J., S. Obermayer Co., Cincinnati, Ohio.
Bumbaugh, W. S., Monessen Fdry. & Machine Co., Monessen, Pa.
Bunsky, G. P., Stark Fdry. Co., Canton, Ohio.
Burgen, J. L., Lane Mfg. Co., Montpelier, Vt.
Burman, F. N., Shirley Radiator Co., Shirley, Ind.
Buyer, George, Barnes Mfg. Co., Mansfield, O.
Cadwell, E. W., Secy. Cincinnati Fdry. Foremen, care S. C., Tatum Co., Cincinnati, Ohio.
Cahill, M., City Fdry. Co., Cleveland.
Caley, Chas. J., Russell & Erwin Mfg. Co., New Britain, Conn.
Caley, H. S., Hart & Crouse Co., Utica, N. Y.
Calhoun, N. S., Johnston & Jennings Co., Cleveland.
Camp, George E., International Heater Co., Utica, N. Y.
Campbell, C. D., Medina Fdry., Medina, Ohio.
Campbell, J. W., Cleveland Wire Spring Co., Cleveland.
Carew, Wm. J., The Essex Fdry., Newark, N. J.
Carhart, Henry E., Canastota, N. Y.
Carleton, J. W., Union Mfg. Co., New Britain, Conn.
Carrick, F. A., The Globe Fdry. Co., Erie, Pa.
Carroll, F. A., THE FOUNDRY, Cleveland.
Carroll, J. T., W. Bingham Co., Cleveland.
Carson, L. L., American Mfg. Co., Pittsburg.
Carter, Frank, Interstate Sand Co., Cleveland.
Cauther, Dan, The Ohio Fdry. Co., Cleveland.
Chamberlain, F. H., J. D. Smith Fdry. Supply Co., Cleveland.
Chambers, W., The Garden City Sand Co., Chicago, Ill.
Chapman, E. M., W. M. Crane Co., Peekskill, N. Y.
Chappelka, A. H. E., Chisholm & Moore Mfg. Co., Cleveland.
Cheney, F. R., Berlin Mach. Wks., Beloit, Wis.
Cherrie, Jas., Friction Pulley Wks., Sandy Hill, N. Y.
Childs, E. D., Kilby Mfg. Co., Cleveland.
Clark, W. J., American Shipbuilding Co., Cleveland.
Clark, Wm., Cleveland Chaplet & Mfg. Co., Cleveland.
Clegg, R. I., Editor *Wood Craft*, Cleveland.
Clement, B. H., Erie Fdry. Co., Rochester, N. Y.
Cleve, J. M., Otis Steel Co., Cleveland.
Clossbey, D. F., The Detroit Stove Co., Detroit, Mich.
Coble, D. C., A. Buch's Sons Co., Elizabethtown, Pa.
Coleman, F. A., J. D. Smith Fdry. Supply Co., Cleveland.
Coleman, W. H., B. F. Sturtevant Co., Chicago.
Comstock, W. A., Cleveland Wire Spring Co., Cleveland.
Corbin, A. F., Union Mfg. Co., New Britain, Conn.
Corse, Wm. M., Detroit Lubricator Co., Detroit, Mich.
Cox, P. J., Michigan Stove Co., Detroit, Mich.
Crabill, C. B., The Fanner Mfg. Co., Cleveland.
Craig, W. D., Canada Iron Furnace Co., Midland, Ont.
Cramer, M. L., The Snow Steam Pump Wks., Buffalo, N. Y.
Crandall, L. A., Detroit Fdry. Supply Co., Detroit, Mich.
Crawford, P. S., U. S. Graphite Co., Saginaw, Mich.
Cray, A. B., Chandler & Price, Palmyra, N. Y.
Cridland, H. C., Dayton, Ohio.
Crivil, G. F., F. B. Stevens, Detroit, Mich.
Crobaugh, Frank L., Cleveland.
Crook, A., Youngstown Sheet & Tube Co., Youngstown, Ohio.
Crosley, J., Multiple Moulding Machinery, Detroit, Mich.
Cross, C. M., Kilby Mfg. Co., Cleveland.
Cronenberger, W. A., Cleveland Chaplet & Mfg. Co., Cleveland.
Cuddy, G. S., The Enterprise Fdry. Co., Detroit, Mich.
Cullen, W. T., Frontier Iron Wks., Buffalo, N. Y.
Culver, Chester M., Murphy Iron Wks., Detroit, Mich.
Cummings, J. W., The U. S. Graphite Co., Saginaw, Mich.
Curley, Jas., Falls Rivet & Mach. Co., Cuyahoga Falls, Ohio.
Cutler, S. C., Republic Belting & Supply Co., Cleveland.
Dailey, Frank, Fdry. Foreman, Walworth Run Fdry. Co., Cleveland.
Daker, J., Hickman, Williams & Co., Cincinnati, Ohio.
Danver, J. H., Beaver, Pa.
Davies, Geo. C., Pilling & Crane, Philadelphia.

Degan, T., American Shipbuilding Co., Cleveland.
Deming, Geo. H., Smith Mfg. Co., Milwaukee, Wis.
DeMooy, Wm., Palmers & DeMooy, Cleveland.
Dempwolf, E. A., E. A. Dempwolf & Sons, York, Pa.
Densmore, R. E., Penton Publishing Co., Cleveland.
Derby, Fred, Taylor & Boggis Co., Cleveland.
Deverell, H. F., Otis Steel Co., Cleveland.
Diemer, H. M., Electric Controller & Supply Co., Cleveland.
Diller, H. E., Western Electric Co., Chicago.
Ditty, R., Buckeye Milling Co., Cleveland.
Dobson, Wm., Canastota, N. Y.
Donnelly, J. E. Jr., Lackawanna Steel Co., Buffalo.
Dopp, I. W., The Tabor Mfg. Co., Chicago.
Douglas, Ed. C., W. & B. Douglas, Middletown, Conn.
Douglass, W. L., Beaver Dam Malleable Iron Co., Beaver Dam, Wis.
Downerd, F. A., American Sand Co., Columbus, O.
Downerd, P. F., American Sand Co., Columbus, O.
Drummond, E. M., Drummond Mfg. Co., Louisville, Ky.
Dubinski, I., Mt. Vernon, O.
Dye, I. F., Newport Sand Bank Co., Newport, Ky.
Dyer, W. E., Port Huron Engine & Thresher Co., Port Huron, Mich.
Eagan, D. F., Henry E. Pridmore, Boston, Mass.
Eastwood, A. C., Electric Controller & Supply Co., Cleveland.
Ebel, G. F., Stark Foundry Co., Canton, O.
Edward, B. H., Detroit Register Co., Detroit, Mich.
Elbon, Chas., Berkshire Mfg. Co., Cleveland.
Erdman, Ed., Interstate Sand Co., Cleveland.
Ericson, C. H., Cleveland Wire Spring Co., Cleveland.
Evans, C. H., Atlas Bolt & Nut Co., Cleveland.
Evans, Jas. A., Erie Laboratory, Erie, Pa.
Evarts, S. I., Penton Publishing Co., Cleveland.
Fahey, Ed., I. S. McCormick Co., Pittsburg.
Falconer, N., Gunn Richards Co., New York City.
Farrow, E. L., Cleveland Wire Spring Co., Cleveland.
Fauver, H. W., Penton Publishing Co., Cleveland.
Fasy, J., W. W. Lindsay & Co., Philadelphia.
Feiss, Geo. J., Superior Foundry Co., Cleveland.
Ferris, H., The Arcade Mfg. Co., Freeport, Ill.
Field, H. E., Mackintosh, Hemphill & Co., Pittsburg.
Finley, M. S., I. D. Smith Foundry Supply Co., Cleveland.
Finucan, T., The Westinghouse Mfg. Co., Cleveland.
Fischer, I. E., Beaver Dam Malleable Iron Co., Beaver Dam, Wis.
Fisher, S. H., Harrisburg Foundry & Mach. Co., Harrisburg, Pa.
Fonda, W. H., Port Huron Engine & Thresher Co., Port Huron, Mich.
Foote, H. M., The A. M. Mfg. Co., Columbus, O.
Fortune, I. R., Murphy Iron Works, Detroit, Mich.
Forwell, Wm., Forwell Fdry. Co., Berlin, Ont.
Fox, M. Z., Hill & Griffith Co., Cincinnati.
Frankel, Philip, National Metal Trades Association, Cleveland.
Frankel, F., Berkshire Mfg. Co., Cleveland.
Franenheim, H. T., Herman Pneumatic Machine Co., Zelienopole, Pa.
Frohman, E. D., The S. Obermayer Co., Pittsburg.
Fromm, Frederick C., Manufacturers' Foundry Co., Waterbury, Conn.
Fuller, Beni. D., Westinghouse Elec. & Mfg. Co., Pittsburg.
Fulton, F. H., Studebaker Foundry Co., South Bend, Ind.
Furguson, Jay, The Ohio Foundry Co., Cleveland.
Gagen, Phil., The Ohio Foundry Co., Cleveland.
Gale, C. H., Penna. Malleable Co., Pittsburg.
Gamble, J. N., Western Tube Co., Kewanee, Ill.
Ganley, M., The Connersville Blower Co., Connersville, Ind.
Gardner, Geo. H., Gardner Publishing Co., Cleveland.
Garrett, James, Acme Foundry Co., Cleveland.
Gartland, T. H., The Best Foundry Co., Bedford, O.
Gartside, Wm. N., Diamond Clamp & Flask Co., Richmond, Ind.
Gaylord, E. S., J. D. Smith Foundry Supply Co., Cleveland.
Geffene, V. P., Acme Foundry Co., Cleveland.
Gerhart, H. J., Penna. Malleable Co., Pittsburg.
Gerdum, A., Walworth Run Foundry Co., Cleveland.
Giesey, V. A., Harbison-Walker Refractories Co., Pittsburg.
Gilbert, H. W., New York Central R. R., Frankfort, N. Y.
Gilbert, L. D., Frick Co., Waynesboro, Pa.
Gilmour, E. B., E. B. Gilmour Foundry Co., Jackson, Mich.
Golden, I. P., Golden Foundry & Machine Co., Columbus, Ga.
Goldrick, R., The Ohio Foundry, Cleveland.
Gomersall, Ben, The Toledo Casting & Forge Co., Toledo, O.
Good, Thomas R., W. & B. Douglas, Middletown, Conn.
Gordon, F. E., The Interstate Sand Co., Conneaut, O.
Gorman, J. W., Ridgeway Machine Tool Co., Ridgeway, Pa.
Goss, A. J., Tabor Mfg. Co., Philadelphia.
Gow, John, General Electric Co., Schenectady, N. Y.
Greenbaum, Wm., Acme Foundry Co., Cleveland, O.
Greene, J. B., Lucas Machine & Tool Co., Cleveland.
Greene, W. B., Palmers & DeMooy Co., Cleveland.
Griffin, W. H., Kilby Mfg. Co., Cleveland.
Griffiths, George H., *The Iron Trade Review*, Chicago.
Grimes, Geo. L., Detroit Stoker & Foundry Co., Detroit, Mich.
Griswold, W. A., Gray & Dudley Hardware Co., Nashville, Tenn.
Groves, S., editor *The Canadian Engineer*, Toronto, Ont.
Gruman, H. W., Interstate Foundry Co., Cleveland.
Grunau, Wm. F., Erie City Iron Works, Erie, Pa.
Guade, Edward R., Oil Well Supply Co., Oil City, Pa.
Guenther, A. M., Goldschmidt Thermit Co., New York City.
Gutsche, J. A., L. S. & M. S. R. R., Cleveland.
Haggerty, H. W., Corrigan, McKinney & Co., Cleveland.
Hall, I. H., Electric Controller & Supply Co., Cleveland.
Halsey, G. P., Erie Foundry Co., Erie, Pa.
Hamel, F., Detroit, Mich.
Hamilton, W., Newport News Ship Building Co., Newport News, Va.
Hammond, A. W., THE FOUNDRY, Cleveland.
Hardy, C. A., Whiting Foundry Equipment Co., Harvey, Ill.
Harpel, Frank T., H. M. Treadwell Co., Lebanon, Pa.
Harris, Irving, Detroit Register Co., Detroit, Mich.
Harrison, A. E., Allis-Chalmers Co., Milwaukee, Wis.
Harrison, Jos., I. D. Smith Foundry Supply Co., Cleveland.
Harrold, Mr., Crescent Machinery Co., Leetonia, O.
Hator, Lee O., Buffalo Co-operative Stove Co., Buffalo, N. Y.
Haurath, A. P., Interstate Foundry Co., Cleveland.
Hawkins, D. S., Westinghouse Mfg. Co., Cleveland.

Heaney, W., The Ohio Foundry Co., Cleveland.
Hector, F. T. D., *The Iron Trade Review*, Cleveland.
Henry, T. E., Medina Foundry Co., Medina, O.
Hepunstall, W. H., Torrance Malleable Iron Co., Troy, N. Y.
Herman, H. C., Herman Pneumatic Machine Co., Zelienople, Pa.
Herron, Chas. Jr., Herron Pump & Foundry Co., Chattanooga, Tenn.
Hessler, Geo. J., Syracuse Foundry Co., Syracuse, N. Y.
Heyl, Martin L., Herman Pneumatic Machine Co., Zelienople, Pa.
Hibbs, Alfred, The U. S. Pipe & Foundry Co., Cleveland.
Hildebrand, L. A., Wellman-Seaver-Morgan Co., Cleveland.
Hickok, Chas. N., M. A. Hanna Co., Cleveland.
Hiers, F. A., Diamond Clamp & Flask Co., Richmond, Ind.
Hill, W. H., Quincy Engine Works, Quincy, Ill.
Hill, J., Hill & Griffith, Cincinnati.
Hill, T., Quincy Engine Works, Quincy, Ill.
Hoholt, C., The Ohio Foundry Co., Cleveland.
Holmes, H. J., L. Schreiber & Sons Co., Cincinnati.
Holzapfel, Wm. J., Crescent Mfg. Co., Scottdale, Pa.
Horning, Jno., The Ohio Foundry, Cleveland.
Hosford, W. B., Dodge Mfg. Co., Mishawaka, Ind.
Hott, Peter, C. & G. Cooper Co., Mt. Vernon, O.
Hough, L. H., Wm. Dobson, Canastota, N. Y.
Housman, R., Kalamazoo, Mich.
Howard, W. B., Detroit Foundry Supply Co., Detroit, Mich.
Howell, Alfred E., Phillips & Buttorff Mfg. Co., Nashville, Tenn.
Hoyt, C. B., The Ohio Cultivator Co., Bellevue, O.
Hubbard, Geo. A., The Millers' Product Co., Chicago.
Hubbard, S. W., Rogers, Brown & Co., Cleveland.
Hulec, Frank, U. S. Bronze Co., Cleveland.
Hunt, D. Jr., Warner & Swasey, Cleveland.
Hurlbut, Emory, THE FOUNDRY, Cleveland.
Huston, R. T., Connersville Blower Co., Connersville, Ind.
Hutton, Wm. W., Advance Thresher Co., Battle Creek, Mich.
Ingalls, C. W., General Pneumatic Tool Co., Montour Falls, N. Y.
Jackson, Eugene, Wellman-Seaver-Morgan Co., Cleveland.
Jackson, Wm. W., Wellman-Seaver-Morgan Co., Cleveland.
Jacobi, Edward, Stirling Consolidated Boiler Co., Mansfield, O.
Jacobs, C. V., Osborn Mfg. Co., Cleveland.
Janke, Robt., Superior Foundry Co., Cleveland.
Jarecki, Chas., Jarecki Mfg. Co., Erie, Pa.
Jenkins, W. A., Olds Motor Works, Lansing, Mich.
Jewell, W. E., Acme Steel & Malleable Iron Co., Buffalo, N. Y.
Johnson, H. W., The Hill Clutch Co., Cleveland.
Johnston, S. T., The S. Obermayer Co., Chicago.
Jones, C. H., Rosedale Foundry & Machine Co., Allegheny, Pa.
Jones, John, Rosedale Foundry & Machine Co., Allegheny, Pa.
Kafer, C. A., Electric Controller & Supply Co., Cleveland.
Kanavel, U. E., Interstate Sand Co., Cleveland.
Karl, Geo., Berkshire Mfg. Co., Cleveland.
Kean, E. A., The Deming Co., Salem, O.
Keep, W. J., Michigan Stove Co., Detroit, Mich.
Keith, F. S., *Canadian Machinery*, Toronto, Canada.
Kelley, G. A., Chisholm & Moore Mfg. Co., Cleveland.
Kelley, W. H., Youngstown Foundry & Machine Co., Youngstown, O.
Kelly, T. P., T. P. Kelly & Co., New York.
Kellner, Wm., The Pattin Bros. Co., Marietta, O.
Kent, R. T., *The Iron Trade Review*, Cleveland.
Kerr, Wm., Chisholm & Moore Mfg. Co., Cleveland.
Kilby, D. J., Kilby Mfg. Co., Cleveland.
Kirkwood, J. W., Fanner Mfg. Co., Cleveland.
Kischel, Otto, Interstate Foundry Co., Cleveland.
Knight, Arthur, American Ship Building Co., Cleveland.
Knodle, C., *The Metal Industry*, Cincinnati.
Koontz, H. C., Interstate Sand Co., Cleveland.
Krouke, A. J., Cleveland Chaplet & Mfg. Co., Cleveland.
Lamp, Henry, Bettendorf Metal Wheel Co., Springfield, O.
Lane, Henry M., editor THE FOUNDRY, Cleveland.
Lane, J. S., Akron, O.
Langsenkamp, Wm. Jr., Langsenkamp Bros. Brass Works, Indianapolis, Ind.
Lathwood, J. A., Lathwood Foundry Co., Pittsburg, Pa.
Laubscher, Henry C., T. H. Brooks Iron Works, Cleveland.
Lauer, Wilhelm, Brebach, Germany.
Lavan, P. H., Interstate Foundry Co., Cleveland.
Lee, J. T., Dealer in Multiple Molding Machinery, Detroit, Mich.
Leland, Henry M., Cadillac Motor Car Co., Detroit, Mich.
Lewis, Wilfred, Tabor Mfg. Co., Philadelphia.
Little, J. W., Landis Tool Co., Waynesboro, Pa.
Logan, J. A., Jones & Laughlin Steel Co., Pittsburg.
Long, John, A. T. Hagen Co., Rochester, N. Y.
Lose, W. H., Iron City Sanitary Mfg. Co., Zelienople, Pa.
Loudon, Archie M., Elmira Heater & Foundry Co., Elmira, N. Y.
Lowe, C. F., The Penton Publishing Co., Cleveland.
Lumley, D. S., L. S. & M. S. Ry. Co., Elkhart, Ind.
Luther, F., Lackawanna Steel Co., Buffalo, N. Y.
Lynch, D. M., A. Buch's Sons, Elizabethtown, Pa.
Lynette, H. A., A. F. A. Exhibit Association, Cleveland.
Lyon, E. J., The Brown & Sharpe Mfg. Co., Providence, R. I.
McBrien, J. V., Western Foundry Supply Co., East St. Louis, Ill.
McCallum, Thomas B., Ball Engine Co., Erie, Pa.
McCaslin, H. J., Wellman-Seaver-Morgan Co., Cleveland.
McCoy, J. P., Baldwin Locomotive Works, Philadelphia.
McClumpha, H. E., National Car Wheel Co., Cleveland.
McCormick, J. S., J. S. McCormick Co., Pittsburg.
McDonald, R. A., Harbison Walker Refractories Co., Pittsburg.
McDonald, T. F., Monarch Engineering & Mfg. Co., Baltimore, Md.
McElvain, M., Berkshire Mfg. Co., Cleveland.
McEwen, H., A. Garrison Foundry Co., Pittsburg.
McFadden, W. H., Mackintosh, Hemphill & Co., Pittsburg.
McGlynn, J. B., City Foundry Co., Cleveland.
Mackenzie, H., American Ship Building Co., Cleveland.
McKnight, H. R., W. S. Tyler Co., Cleveland.
McLean, E., South Altoona Foundry, Altoona, Pa.
MacMeekin, J. B., Abram Cox Stove Co., Philadelphia.
McNeal, Chas. P., Garden City Sand Co., Chicago.
McQuillan, W. S., Colonial Foundry & Machine Co., South Norwalk, Conn.
McRoberts, S. A., *Industrial World*, Pittsburg.
Mack, C. F., Kilby Mfg. Co., Cleveland.

Maley, H., The City Foundry Co., Cleveland.
Malone, T. E., J. S. McCormick Co., Pittsburg.
Man, F. J., Republic Belting & Supply Co., Cleveland.
Martin, James V., Monarch Engineering & Mfg. Co., Baltimore, Md.
Martin, S. A., Penna. R. R. Co., Altoona, Pa.
Mayon, Joe, The Best Foundry Co., Bedford, O.
Mead, Wm. J., Pigott, Mead & Co., Cleveland.
Meaber, Edwin, Zelienople, Pa.
Meighan, John A., Dawson Bros. & Meighan, Pittsburg.
Melville, G. E., Tabor Mfg. Co., Philadelphia.
Melvin, Henry, Buhl Malleable Co., Detroit, Mich.
Meriam, J. B., Bowler Foundry Co., Cleveland.
Merriman, M. W., Madison Avenue Foundry Co., Cleveland.
Meyers, R. C., Stark Foundry Co., Canton, O.
Michel, Wm. J., Tarrant Foundry Co., Chicago.
Miers, Alfred, Walkerville Malleable Iron Co., Walkerville, Ont.
Millard, A. C., Taplin Rice Co., Akron, O.
Miller, B. A., Chisholm & Moore Mfg. Co., Cleveland.
Miller, Chas. J., Medina Foundry Co., Medina, O.
Miller, C. M., Superior Foundry Co., Cleveland.
Miller, H. S., Buckeye Milling Co., Cleveland.
Mills, H. E., C. E. Mills Oil Co., Syracuse, N. Y.
Mills, J., Chicago Pneumatic Tool Co., Cleveland.
Mills, J. F., Abendroth Bros., New York City.
Moore, T. H., Republic Belting & Supply Co., Cleveland.
Mohr, G. P., W. W. Sly Mfg. Co., Cleveland.
Moldenke, Dr. Richard, Sec'y. American Foundrymen's Association, Watchung, N. J.
Molder, H. M., The Best Foundry Co., Bedford, O.
Mollen, James F., The Variety Iron Works Co., Cleveland.
Montague, Geo. C., Norton Emery Wheel Co., Worcester, Mass.
Morton, James N., Monarch Engineering & Mfg. Co., Baltimore, Md.
Moody, R. C., Cleveland Wire Spring Co., Cleveland.
Moore, V. A., Chisholm & Moore Mfg. Co., Cleveland.
Morcon, I. H., Colorado Iron Works Co., Denver, Colo.
Morgan, Thos. J., Standard Sand & Mach. Co., Cleveland.
Morgan, W. J., Winton Motor Carriage Co., Cleveland.
Morrison, E. A., Fremont, O.
Mott, A. C. Jr., Abram Cox Stove Co., Philadelphia.
Mumford, E. H., The E. H. Mumford Co., Philadelphia.
Murphy, James A., Interstate Foundry Co., Cleveland.
Murphy, W. C., New Brighton, Pa.
Needham, Wm., Chicago Pneumatic Tool Co., Cleveland.
Neuert, Otto H., Kilby Mfg. Co., Cleveland.
Newmann, Philip, Interstate Foundry Co., Cleveland.
Newbold, Sidney, Tabor Mfg. Co., Philadelphia.
Nicholls, W. H., Berkshire Mfg. Co., Cleveland.
Noll, Wm., The Wm. Tod Co., Youngstown, O.
Norstrand, H. P. G., Rathbone, Sard & Co., Albany, N. Y.
Nusser, J. H., National Gear Wheel & Foundry Co., Allegheny, Pa.
Nuterzuter, C. H., Cleveland Chaplet & Mfg. Co., Cleveland.
Ober, A. M., Ober Mfg. Co., Chagrin Falls, O.
Oberhelman, Wm., Hill & Griffith Co., Cincinnati.
Oldfield, Harry, Goulds Mfg. Co., Seneca Falls, N. Y.
Olsen, C. O., Johnston & Jennings Co., Cleveland.
O'Neil, J. P., Western Foundry Co., Chicago.
O'Neill, Thos., Filer & Stowell Co., Milwaukee, Wis.
Ormrod, J. D., Donaldson Iron Co., Emaus, Pa.
Ott, Chas., Wellman-Seaver-Morgan Co., Cleveland.
Osborn, J. W., Walworth Run Foundry Co., Cleveland.
Paehlke, Otto F., Allyne Brass Foundry Co., Cleveland.
Parry, Wm. H., National Meter Co., Brooklyn, N. Y.
Pattin, W. S., The Pattin Bros. Co., Marietta, O.
Paul, Richard, Medina Foundry Co., Medina, O.
Peebles, R. P., Turner, Vaughan & Taylor Co., Cuyahoga Falls, O.
Penton, John A., Cleveland.
Perkins, F. N., Arcade Mfg. Co., Freeport, Ill.
Perrine, W. A., Abram Cox Stove Co., Philadelphia.
Peters, M. W., Madison Avenue Foundry Co., Cleveland.
Pickands, J. M., Pickands, Mather & Co., Cleveland.
Pickup, G. E., Wehrle Stove Co., Newark, O.
Pigott, Thomas E., Pigott, Mead & Co., Cleveland.
Pinney, H. H., Westinghouse Elec. & Mfg. Co., Cleveland.
Power, R. E., editor *Boating*, Cleveland.
Price, W. A., Berkshire Mfg. Co., Cleveland.
Pridmore, F. A., Henry E. Pridmore, Chicago.
Pridmore, H. A., Henry E. Pridmore, Chicago.
Pridmore, Henry E., Chicago.
Putnam, W. P., Detroit Testing Laboratory, Detroit, Mich.
Quinn, Hugh T., Eaton, Cole & Burnham Co., Bridgeport, Conn.
Radigan, J. E., Interstate Foundry Co., Cleveland.
Ramp, H. M., General Electric Co., Schenectady N. Y.
Ramp, P. R., Murray Iron Works Co., West Burlington, Ia.
Ranney, H. P., American Ship Building Co., Cleveland.
Rathbone, J. A., Detroit, Mich.
Rath, C. J., The Fulton Foundry, Cleveland.
Reddington, P., Silver Mfg. Co., Salem, O.
Redmond, Geo. F., Interstate Foundry Co., Cleveland.
Reese, John, Falls Rivet & Machine Co., Cuyahoga Falls, O.
Reid, D., Canadian Westinghouse Co., Hamilton, Ont.
Reilly, James, Westinghouse Mfg. Co., Cleveland.
Richardson, W. G., Allis Chalmers Co., Milwaukee, Wis.
Riddell, W. A., Sharon Foundry Co., Sharon, Pa.
Ring, R. H., Cortlandt Corundum Wheel Co., Cortlandt, N. Y.
Roche, Thos., National Car Wheel Co., Cleveland.
Rodgers, J. A., Western Foundry Supply Co., East St. Louis, Ill.
Roedell, Wm. A., Kennedy Valve & Mfg. Co., Coxsackie, N. Y.
Roseberry, W. J., Municipal Engineering & Contracting Co., Cleveland.
Ross, J. W., Landis Tool Co., Waynesboro, Pa.
Rouse, R., The Boynton Furnace Co., Jersey City, N. J.
Ruthenberg, Gus, Allyne Brass Foundry Co., Cleveland.
Rutson, W., Buckeye Sand Co., Pittsburg.
Ryan, D. J., Interstate Foundry Co., Cleveland.
Sands, James, Superior Foundry Co., Cleveland.
Sargent, W. P., Niles Tool Works, Hamilton, O.
Saveland, Harry, Acme Foundry Co., Cleveland.
Scheel, M. J., The W. S. Tyler Co., Cleveland.
Scheen, D. J., Interstate Foundry Co., Cleveland.
Schilling, Joseph, Russell & Erwin Mfg. Co., New Britain, Conn.
Schlichte, George, Falls Rivet & Mach. Co., Cuyahoga Falls, O.

Schoenberger, W. J., United Brass Co., Cleveland.
Schowe, H. G., Bowler Foundry Co., Cleveland.
Schreiber, Wm. A., Schreiber & Sons Co., Cincinnati.
Schwab, J., Skinner Engine Co., Erie, Pa.
Schwarzenberg, H. L., Waterbury Crucible Co., Cleveland.
Schwoerer, F. C., Acme Foundry Co., Cleveland.
Scofield, Lane, The Tabor Mfg. Co., Philadelphia.
Scott, Arthur, Cleveland Pneumatic Tool Co., Cleveland.
Scoville, F. S., C. E. Mills Oil Co., Syracuse, N. Y.
Seaman, I. S., Seaman-Sleeth Co., Pittsburg.
Seedhouse, Edwin, Falls Rivet & Machine Co., Cuyahoga Falls, O.
Seelbach, Charles, Forest City Foundry, Cleveland.
Seidler, Wm., Jarecki Mfg. Co., Erie, Pa.
Shaver, G. N., Crystal Fluor Spar Mining Co., Cleveland.
Shed, N. W., The Buffalo Foundry Co., Buffalo, N. Y.
Shennan, W. J., Bethlehem Steel Co., Bethlehem, Pa.
Sherwin, Edward J., Wellman-Seaver-Morgan Co., Akron, O.
Sherwood, Chas., Republic Belting & Supply Co., Cleveland.
Sinclair, D. G., Illinois Steel Co., South Chicago, Ill.
Skiff, Warner, Westinghouse Electric & Mfg. Co., Pittsburg.
Skully, W. C., Smith & Anthony Co., Boston, Mass.
Sleeth, S. D., Westinghouse Air Brake Co., Pittsburg, Pa.
Slocum, A. W., Dickson Car Wheel Co., Houston, Texas.
Sly, W. C., Sly Mfg. Co., Cleveland.
Sly, W. W., Sly Mfg. Co., Cleveland.
Smart, George, Editor *The Iron Trade Review*, Cleveland.
Smith, C. T., Chicago Pneumatic Tool Co., Cleveland.
Smith, F. G., Osborn Mfg. Co., Cleveland.
Smith, F. N., S. R. Dresser Mfg. Co., Bradford, Pa.
Smith, J. S., J. D. Smith Foundry Supply Co., Cleveland.
Smith, P. C., Ingersoll-Rand Co., Phillipsburg, N. J.
Smith, P. G., J. D. Smith Foundry Supply Co., Cleveland.
Smith, Wm., Standard Sand & Machine Co., Cleveland.
Smith, W. H., Standard Sand & Machine Co., Cleveland.
Somerwill, W. J., Palmers & DeMooy Foundry Co., Cleveland.
Southcourt, H. P., Holland Linseed Oil Co., Chicago.
Sords, I. F., Interstate Foundry Co., Cleveland.
Stadelman, W. A., Wellman-Seaver-Morgan Co., Cleveland.
Starcher, J. H., William Dobson, Pittsburg.
Steinfurth, J. C., Cascade Foundry Co., Erie, Pa.
Stephenson, B. S., *The Iron Trade Review*, Cleveland.
Stevens, Frederic B., Detroit, Mich.
Stoddard, J. D., The Detroit Testing Co., Detroit, Mich
Stone, Bert, Walworth Run Foundry Co., Cleveland.
Stone, H. H., Penna. R. R., Altoona, Pa.
Strangward, Wm., Forest City Foundry Co., Cleveland.
Strangward, P., Forest City Foundry Co., Cleveland.
Stratton, Dr. S. W., Director National Bureau of Standards, Washington, D. C.
Strehler, Alfred, Clemens Const. Co., Cleveland.
Streich, E. F., Osborn Mfg. Co., Cleveland.
Stutz, Ernest, Goldschmidt Thermit Co., New York.
Sweeney, A. J., Corrigan, McKinney & Co., Cleveland.
Sweeney, M. J., Interstate Sand Co., Cleveland.
Swift, Chas. C., City Foundry Co., Cleveland.
Ten Winkel, W. A., Electric Controller & Supply Co., Cleveland.
Thompson, W. R., Interstate Sand Co., Detroit, Mich.
Thomas, D. J., Sterritt Thomas Foundry Co., Pittsburg.
Thorner, Justus, The S. Obermayer Co., Cincinnati.
Thrasher, G. M. Jr., Western Tube Co., Kewanee, Ill.
Tidball, R., Buckeye Milling Co., Cleveland.
Tingle, A. R., The American Sand Co., Columbus, O.
Titus, T., Titus Foundry, Coldwater, Mich.
Tobien, R. C., The Ohio Foundry Co., Cleveland.
Tolmie, R. C., Lobdell Car Wheel Co., Wilmington, Del.
Towns, F. I., Pittsburg Valve & Fittings Co., Pittsburg.
Towers, J. F., Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trabue, W. D., Phillips & Buttorff Mfg. Co., Nashville, Tenn.
Trenkamp, John, The Ohio Foundry Co., Cleveland.
Troegele, Chas., Walworth Run Foundry Co., Cleveland.
Troy, Andy, The Interstate Foundry Co., Cleveland.
Turnney, P. J. F., Turnney Copper & Bronze Co., Cleveland.
Turnbull, R. E., Henry E. Pridmore, Chicago.
Urwin, J. W., Massillon Sand & Stone Co., Massillon, O.
Vetterlein, John, Chisholm & Moore Mfg. Co., Cleveland.
Wadsworth, J. L., The Penton Publishing Co., Cleveland.
Wadsworth, Geo. W., Falls Rivet & Machine Co., Cuyahoga Falls, O.
Wainwright, W., Falls Rivet & Machine Co., Cuyahoga Falls, O.
Waite, Geo. E., Ober Mfg. Co., Chagrin Falls, O.
Waite, Geo. W., Friction Pulley & Machine Works, Sandy Hill, N. Y.
Wagner, L. G., Acme Foundry Co., Cleveland.
Walda, Wm. C., Central Foundry Co., Fort Wayne, Ind.
Wales, A., Russell Engine Co., Massillon, O.
Wallis, W. R., *The American Machinist*, New York City.
Walton, Geo., Madison Avenue Foundry Co., Cleveland.
Wathey, Arthur, Allyne Brass Co., Cleveland.
Wathey, T., Macbeth Iron Co., Cleveland.
Watters, J., Western Foundry Co., Chicago.
Weaver, George H., Dominion Foundry & Supply Co., Montreal, Can.
Webb, J. F., L. S. & M. S. R. R., Elkhart, Ind.
Webster, J. R., C. E. Mills Oil Co., Syracuse, N. Y.
Webster, J. H., Buckeye Milling Co., Cleveland.
Wegat, Art., The Ohio Foundry, Cleveland.
Weidler, E. V., Oil Well Supply Co., Oil City, Pa.
Weirich, S. R., Myers & Gardner, Massillon, O.
Wennick, A. B., Walworth Run Foundry Co., Cleveland.
West, Ralph D., Cleveland.
West, Thos. D., Pres. American Foundrymen's Association, Sharpsville, Pa.
White, Frank C., White Tool & Supply Co., Cleveland.
White, J., C. H. & D. R. R., Lima, O.
Wieman, Wm., Robert Field Sales Agency, Pittsburg.
Wilkins, Geo. W., The Erie Foundry Co., Erie, Pa.
Wilkinson, S., Abendroth & Root, Newburg, N. Y.
William, A. T., Enterprise Mfg. Co., Philadelphia.
Williams, R. D., *The Marine Review*, Cleveland.
Williams, L. A. Jr., Atlas Car & Mfg. Co., Cleveland.
Wilson, H., Rogers, Brown & Co., Cleveland.

SOME OF THE SOUVENIRS.

Wilson, J. J., The Cadillac Motor Car Co., Detroit, Mich.
Wilson, Wm. M., Frederic B. Stevens, Detroit, Mich.
Winlock, J. P., Barbour-Stockwell Co., Cambridge, Mass.
Wooden, P. M., Reeves & Co., Columbus, Ind.
Woodison, E. J., Detroit Foundry Supply Co., Detroit, Mich.
Wright, W. B., Youngstown, O.
Wright, Henry, Otis Elevator Co., Cleveland.
Yagle, Wm., Yagle Mfg. Co., Pittsburg.
York, R. H., Berkshire Mfg. Co., Cleveland.
Young, J., Penna R. R., Altoona, Pa.
Zilles, P. C., Wellman-Seaver-Morgan Co., Cleveland.
Zimmers, F. H., Union Foundry & Machine Co., Pittsburg.

CONVENTION SOUVENIRS.

The convention this year was marked by an unusually fine line of souvenirs. The Osborn Mfg. Co., of Cleveland, gave a box containing a clothes brush. On the back of the brush was the advertisement of the Osborn Mfg. Co., maker of foundry supplies, Economy wire wheels, and all kinds of brushes for foundry and platers' use. Upon the outside of the box was a statement that the brush was given at the convention of the American Foundrymen's Association, June, 1906.

The Hill & Griffith Co., of Cincinnati, O., gave a very pretty metal plaque, with a picture of a girl surrounded by a border of lilies upon it. The plaque was arranged to be supported in a vertical position in a wire holder.

E. A. Dempwolf & Sons, of York, Pa., presented the members with a numerical mind reader for telling anyone's age, which consisted of a number of cards cut in such a way that when the ones containing the age were properly assembled the age could be read upon the face.

The Interstate Sand Co., of Cleveland, gave away two souvenirs, one of which was a pocket book with a long pocket for bills and several small pockets for cards, and also a leather match safe with a small pocket for street car tickets and a piece of sand paper protected by a leather flap.

The C. E. Mills Oil Co., of Syracuse, N. Y., gave away the most striking novelty of the convention in the form of a trick match box, which was so arranged with a false bottom and lock that when in one position it would open so as to show the matches and in another position would show only an empty box. Upon the outside of the box was printed. "You cannot find a match for Mills' No. 1 and No. 2 Dry Core Compound, or Syracuse X-XX-XXX core oil."

The W. W. Lindsay Mfg. Co., of Philadelphia, gave a very neat paper weight in the shape of a tinned chaplet with the firm's name stamped on the head.

"Uncle Billy," of the Garden City Sand Co., Chicago, presented his friends with a fountain pen, which was appreciated by all the recipients.

Mr. Chas. J. Caley, of the Russell & Erwin Mfg. Co., New Britain, Conn., presented the ladies of the party on the day of the boat ride with a very pretty bronze souvenir paper cutter, which was presented in a box lined with plush.

The Standard Sand & Machine Co., of Cleveland, made those who visited this exhibit happy by presenting them with a neat little wallet for change.

Knowing the propensities of many of the foundrymen for forgetting their location after an evening's pleasure, Jimmie Smith, of the J. D. Smith Foundry Supply Co., Cleveland, selected as a suitable gift for his friends an initial watch fob which was very neatly gotten up. Upon the front there is an enameled initial letter of the receiver and on the back the statement that it is presented with the compliments of the J. D. Smith Foundry Supply Co.

The Western Foundry Supply Co., of East St. Louis, Ill., gave sample bags containing ground 80 per cent ferro-manganese, each sample being enough for a fair trial in a small ladle of iron.

The Berkshire Mfg. Co., Cleveland, had prepared and cast a series of paper weights which were molded on the Berkshire machine. Upon the upper face of the paper weight is a relief picture of the Berkshire molding machine.

The Norton Emery Wheel Co., of Worcester, Mass., presented a leather match safe with a place for striking the matches under the flap.

Wm. Dobson, of Canastota, N. Y., manufacturer of molders' tools, distributed a six-inch aluminum rule with his advertisement stamped upon it.

Some of the most important gifts, however, were along the smoking line. The W. W. Sly Mfg. Co., of Cleveland, presented its friends with an aluminum cigar case, containing three good smokes.

The Falls Rivet & Machine Co., of Cuyahoga Falls, O., presented all of the members at the smoker with a cigar pouch containing four first-class cigars. Upon the front of the case was the statement: "These sample cores were made on the Wadsworth improved core machine by the Falls Rivet & Machine Co., engineers, machinists and founders, of Cuyahoga Falls, O."

The Chicago Pneumatic Tool Co. presented the guests at the smoker with a high-grade corn cob pipe, while the local committee handed out a souvenir bag of tobacco, a souvenir beer stein and cigars banded with A. F. A. and A. F. F.

The U. S. Graphite Co., of Saginaw, Mich., distributed pencils made from its Mexican mine graphite.

The Buckeye Milling Co., Cleveland, O., distributed pound bags of Wago core compound and also large wall calendars.

Henry E. Pridmore, Chicago, manufacturer of the "Pridmore" molding machines, is known for the handsome souvenirs he distributes at the conventions of the American Foundrymen's Association. This year, his remembrance is a most useful one from a man's standpoint. It is a beautiful French briar pipe, with amber mouthpiece. The bowl is highly polished, the rim and neck being surrounded with solid gold bands. It is a costly gift, and one that will be highly appreciated by every recipient. It is not a large pipe, nor a heavy one, and it can be held in the mouth or carried in the pocket without any inconvenience to the user. A leather case goes with each pipe.

The Goldschmidt Thermit Co., of New York city, distributed a memorandum pad which was bound in leather and contained sheets of paper for memoranda which were secured by

A FEW OF THE SOUVENIRS.

the corners as shown in the accompanying illustration.

The Diamond Clamp & Flask Co., of Richmond, Ind., distributed a looking glass in a celluloid frame, upon the back of which there was a picture of Mr. Gartside's new Universal core machine, being operated by a pretty girl.

J. Frank Dye, of the Newport Sand Bank Co., of Newport, Ky., left a sweet memory behind him by distributing small sachet bags. He said that they were guaranteed to always smell just as sweet, provided you kept enough perfumery in them.

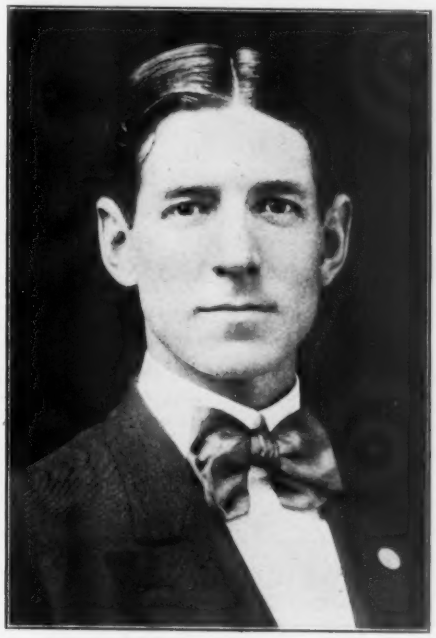
The Buckeye Milling Co., of Cleveland, distributed a celluloid envelope opener, with an advertisement of the Superior core flour printed upon the back.

In this connection we cannot help but call attention to the fact that bringing the entertainment features of the convention into the hands of the newly formed supply men's association will have a tendency to reduce the grabbing of souvenirs by parties who have no right to them and of repeating on the part of many of the souvenir hunters. This matter, however, is mentioned more fully in another part of this issue.

W. H. McFADDEN, PRESIDENT OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

W. H. McFadden, newly elected president of the American Foundrymen's Association, is one of the best known and most popular manufacturers in the country. He is vice president and general manager of Mackintosh, Hemphill & Co., of Pittsburg, and his entire career in the iron and steel business has been in connection with this company.

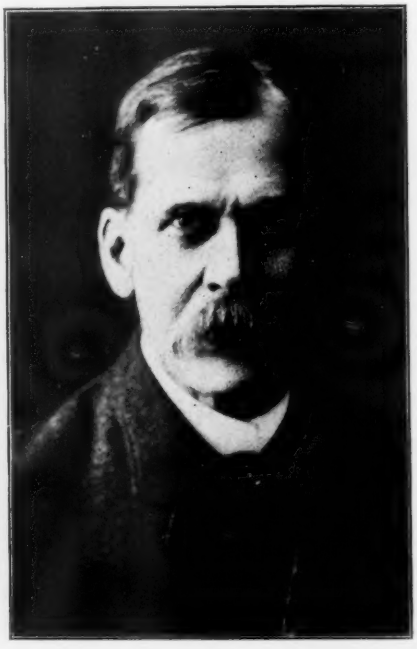
Mr. McFadden is a self-made man, who, by native ability and steady application, advanced himself from machinist apprentice to general manager of one of the largest concerns of its kind in the country. For many years he has been actively identified with the National Founders' Association as chairman of the third district and has served on its administrative council and assisted in this capacity in concluding successfully many of its most important conferences between that association and the molders' union. He was also president of the Pittsburg Manufacturers' Association in 1905 and president of the Pittsburg Foundrymen's Association the same year. Under Mr. McFadden's supervision, machinery for the following plants was built and erected: Ashland Steel Co., Bellaire Steel Co., Benwood Steel



W. H. MCFADDEN, PRESIDENT THE A. F. A.

Works, Bethlehem Steel Co., Colorado Fuel & Iron Co., Duquesne Steel Works, Edgar Thomson Steel Works, Jefferson Iron Works, Hainsworth Steel Co., Homestead Steel Works, Jones & Laughlin Steel Co., Junction Steel & Iron Co., Joliet Steel Works, King, Gilbert & Warner Co., Troy Steel Co., Lackawanna Steel Co., Maryland Steel Co., National Tube Co., and its different plants, Passaic Rolling Mill Co., Phoenix Iron Co., Eastern Steel Co., Park Brothers & Co., Portsmouth Steel Co., Riverside Iron Works, Roane Iron Co., Spang, Chalfant &

C. J. CALEY, VICE PRESIDENT THE FIRST DISTRICT.



W. J. KEEP, VICE PRESIDENT THE FIFTH DISTRICT.

Co., Schoenberger Steel Co., Shenango Valley Steel Co., Cambria Steel Co., Dominion Iron & Steel Co., Worcester Steel Works, New York State Steel Co., Youngstown Sheet & Tube Co. and Millikin Bros.

In April, 1888, Mr. McFadden

JOHN W. BURR, VICE PRESIDENT THE SECOND DISTRICT.

JOHN HILL WHITING, VICE PRESIDENT THE FOURTH DISTRICT.

started as a general apprentice in the machine shop and drawing room of Mackintosh, Hemphill & Co., Ltd., and served time in the foundry and pattern shop. Eager to master his chosen profession, Mr. McFadden, by over time and Sunday work, served one year and five months additional apprenticeship, or during his three years' term by this means served four years and five months. In 1891, before he had finished his apprenticeship, Mr. McFadden was sent by his company to

L. L. ANTHES, VICE PRESIDENT THE EIGHTH DISTRICT.

superintend the construction of the Ashland Steel Co.'s plant at Ashland, Ky., and in 1892, returned and finished his time in the shops.

In 1893, he was made foreman of the open-hearth steel department of Mackintosh, Hemphill & Co., Ltd., and held this position one year, when, in 1894, he was made general superintendent of the whole plant. In 1895, while acting as superintendent of the plant, he assumed the additional duties of superintending the building of the Star tin plate plant, including both buildings and machinery. In 1896, Mr. McFadden was made assistant manager of Mackintosh, Hemphill & Co., and held this position until 1902, when, under the partial reorganization of the company, and the retirement of Mr. Hemphill, he was made vice president and general manager, which position he still holds.

Mr. McFadden is a tireless worker and in connection with his election as president of the American Foundrymen's Association, he said he is going to put forth every effort to make this year the greatest in the history of the organization.

PATTERN SHOP EQUIPMENT.

BY THE MEMBERS OF THE CLEVELAND PATTERNMAKERS' ASSOCIATION.*

The most advantageous arrangement that can be given a pattern shop depends wholly upon the floor plan, the number of men employed, and the character of the work. The character of the work in turn determines in a large measure the size of the pattern shop, the equipment required, and the location of the shop. When possible, the pattern shop should be placed on the ground floor, and this is particularly true where large face plate lathes are employed, as their foundations cannot be made too rigid.

The inconvenience attending the getting of large patterns up and down the stairway, or on and off an elevator, as the case may be, is another good reason why the ground floor is a better location for this department.

The handling of the lumber into the shop can also be accomplished with very much greater ease if the ground floor is selected.

Power Transmission.

The ideal arrangement for power transmission is, of course, electrical driving with a motor for each machine. Band saws are now made with a motor directly connected to the shaft of the lower wheel, while all the other machines can be driven by a motor mounted upon the machine bed, or upon the floor adjoining it. These motor drives take up but a small amount of space, and do away in part with the nuisance of belts. In the case of a jobbing pattern shop an important consideration is that the power is usually rented, and when elec-

*Paper presented at the A. F. A. Convention, Cleveland, June, '06.

trical driving is employed only the machines in actual use need be run, which will result in a very marked saving in the total year's expenditure for power. When this system is not installed and line shaft is used, it should be placed below the floor, in order to facilitate its control and avoid the loss of floor space taken up by countershafts, shifters, etc. When the line shaft is arranged in this manner it will necessitate a shallow basement underneath the pattern shop. Machines requiring heavy foundations can be placed on concrete piers extending through the basement.

Pattern Shop Arrangement.

The ceiling of the shop should be high and well supported, preferably by carrying it with truss rods from the roof, as this will avoid columns or other supports which are in the way of laying out or constructing large work. Plenty of heat and light are two very essential features in the pattern shop, and should always be kept in the foreground when laying out this department. The lavatory and cloak room are also important. The cloak room should be fitted with individual lockers for the workmen's garments, and should be in charge of the sweeper or some other party who will see that it is kept locked during working hours and also that it is kept clean and well ventilated. It is a serious mistake to place the cloak room in some dark, out-of-the-way hole. It should be so located that it is light and airy in order that it may be kept clean and sweet.

The foreman's office should receive attention early in the lay out. If the shop is long, the office should be located along one wall near the center of the shop, the office floor being raised about four feet above the general shop floor, and the walls constructed of glass. There are two advantages in this arrangement; first, it gives the foreman command of the entire floor so that he can see what is going on at all times. Second, it places the office in the warm air stratum of the room. A man at work can keep warm in a temperature of from 67 to 68 degrees Fahr., which is about right for the ordinary pattern shop, but a man sitting at a desk usually wants a slightly higher temperature.

One important department which often receives scant attention is the finishing department. To do good varnishing the temperature should be kept above that of the ordinary working rooms, and the air should be free from dust. To accomplish this it is necessary to partition off a separate space and set it aside for checking up and finishing patterns. This work should, wherever possible, be conducted by men assigned especially to this class of work and not by the regular patternmakers. Where two radically different classes of patternmakers are carried on, as for instance, wood and metal or heavy and light, two separate pattern rooms are sometimes used with the foreman's office and finishing room located between them. The stock room can also be located between the pattern shops. The stores or supplies should be in charge of one man, who should issue them and see that they are charged to the proper jobs.

When the material or lumber is gotten out by each individual workman, which is the customary practice in most shops, and especially when the number of workmen will not warrant a man being employed in that particular capacity, the placing of the lumber within easy reach is frequently overlooked. What is more exasperating to a workman than to stop in the midst of his work, and frequently be obliged to go out of the building, open up the kiln or dry house and get a board, if he has the misfortune to fail in getting out the required amount at the beginning of the job.

As our lumber dealers are not a very scrupulous lot, getting suitable lumber that can be worked up into patterns immediately is a game of chance, and unless a dry house or kiln is at your disposal, badly warped or unreliable patterns or a stock of lumber far in excess of the demand will evidently be found.

Common experience teaches that if the dry room be against the outer wall of the building and the necessary openings provided through the wall at the end of each rack, the lumber racks can then be so arranged that the racking of lumber can be done from the outside, and taken into the shop through the openings provided. Of course the first lumber in

would be the first lumber used. It will be seen that this arrangement would provide dry lumber with a small lay out of stock, providing the racks were kept filled. With this mode of drying lumber a steam box for the heating of material prior to glueing can be easily arranged, as all that is required is the enclosing of one of the lumber racks and placing within this enclosure a series of steam pipes, providing the temperature of the dry house is not sufficient.

Assuming that the room is rectangular, the most convenient disposition is to place the work benches along one side and the machinery along the other, in the case of a small shop. By this arrangement the dust and shavings can be kept under control and the transmission of power to the machines is simplified. In the case of a somewhat larger shop where the dimensions of the floor are about equal lengthwise and across, the benches may be arranged along each side of the room and the machines placed in the center or at the end of the shop. In the case of a large shop a duplicate group of machines can be placed at each end.

The usefulness of machines depends largely upon the character of the work being done, and upon the condition in which they are kept. Fortunate indeed is the pattern shop that has a mechanic capable of keeping the machines in the best working order and at the same time making himself generally useful in the way of getting out lumber, glueing up material, etc.

A good speed for the line shaft is from 250 to 300 revolutions per minute, as all wood working machinery requires high speed and a moderately high speed on a line shaft will be found advantageous, as it will result in smaller pulleys than if a lower speed of line shaft prevailed. The machines should be so located on the floor as to minimize the handling of the material. For instance, if the lumber can be brought in and passed over the rip saw, then over the jointer and back through a surface planer, it will always be kept moving lengthwise of the floor and the amount of handling minimized. After the work leaves the thickness planer it should pass to the cutting-off saw.

A blower system should be installed for taking the shavings away from the machines, and especially from the sandpapering machine, as the dust is not only detrimental to the health of the men, but a dusty shop is a bad investment for the firm, as the men cannot turn out so much work when they have to keep digging dust out of their eyes. Some of the outlets, or rather intakes, for the dust collector system should be located near the benches, so that dust and shavings resulting from hand work may be swept into them. These openings, when not in use, should be kept closed with a slide or hinge door.

The selection of machines is an important item and one which is worthy of a good deal of study. There are some machines which will pay a splendid rate of interest on their investment, even though they may be used less than an hour a day. A core box machine belongs to this class, for with it a man can produce in a few minutes results which it would take him hours to accomplish by hand, and at the same time turn out more accurate work. It is also bad policy to have one man waiting for another at the machines, for patternmakers' time is expensive and two hours time of a patternmaker will pay a good rate of interest on $12 per year. It can readily be seen that it would not take many such delays as this to warrant the duplication of a portion of the machine equipment. This is particularly true of band saws and small universal combination cross cut and rip saws, also of lathes.

The machine equipment of a shop doing a general line of work and employing 24 or more men should consist of the following:

At least four lathes, one of which should be a heavy combination or universal lathe capable of turning out face plate work up to 15 feet in diameter, and cylindrical or stave work to the diameter of 72 inches between the centers. There are several lathes of this design on the market. Another should be a combination face plate and tail stock lathe with power feed and an over-

hanging face plate which will swing work up to about six feet in diameter. It should also be capable of turning work 30 inches in diameter and 12 feet long between centers. One of the other machines should be a 16 or 24-inch lathe and the remaining one a small speed lathe. The speed of wood turning lathes will vary from 1,000 to 2,500 feet per minute at the surface of the work. The great range of speeds given is due to the fact that in the case of very large work it is impossible to accomplish the high speeds. This is also true in the case of very small work.

The most important machine after the lathe is the band saw. At least two of these should be installed, one being a right-hand and the other a left-hand machine. It is also well to have one ordinarily equipped with a ¾-inch or 1-inch saw for ordinary segment sawing, etc., and the other with a ⅜-inch saw for light work with small radii. Band saws do good work when running at a lineal speed of from 3,500 to 4,000 feet per minute. Good results can only be obtained by keeping the saws in perfect order, and to accomplish this a filing and setting machine should be installed.

The jig saw or scroll saw still holds its place in many pattern shops for doing inside work, that is, for sawing out the inside of a closed figure. This saw, however, is very slow in its action, as it is only cutting half of the time and then at a variable speed.

The circular saw equipment should comprise at least three machines. A swing or table cut off saw, rip saw table, carrying a saw 24 inches in diameter, and the other a universal table carrying two 14-inch saws, one a rip and the other a cross cut. Good results are obtained from a peripheral speed of from 3,000 to 10,000 feet per minute in the case of rip and cross cut saws working on dry white pine lumber.

Two joiners or hand planers are essential. One should be a 16-inch, and the other a 24-inch machine. The 24-inch machine should be arranged with a tilting table, which can be used for giving draft upon flat work. These machines should run at a speed of over 5,000 feet per minute. In many shops the jointer is used entirely for planing boards out of wind, but some still prefer the Daniels planer for this purpose, and recommend that it be included in any modern pattern shop equipment. It is certainly a very efficient machine in many ways, and especially for planing boards previous to passing them through the thickness planer. The cutters of a Daniels planer should run at a speed of from 10,000 to 11,000 feet per minute.

A surface or thickness planer is indispensable and should have a width of from 26 to 30 inches and be capable of handling stock from ⅛ inch to eight inches in thickness. It should be equipped with power driven upper and lower feed rollers. The speed is the same as that of the jointer or hand planer.

A vertical boring machine will be found very useful and will produce good results when equipped with Forstner bits in the way of depressing or routing out surfaces. This machine should be capable of boring holes up to two inches in diameter and arranged with a variable speed having a range of from 600 to 1,200 revolutions per minute.

A core box machine is another very useful tool in the pattern shop, as it will produce or dress out core boxes of any length and from ¾ of an inch to 22 inches in diameter. It can also be used for quarter turned, curved and straight work. Another use of the core box machine is found in the working out of the curved sides of staves, fillets, etc.

One of the most recent additions to the machine equipment of a pattern shop is the sand papering machine or universal sander. This consists of a disc covered with garnet sand paper and a spindle upon which rolls of different diameters covered with the same material can be placed. The variety of work that can be produced upon a machine of this sort is surprising and no pattern shop equipment is complete without one.

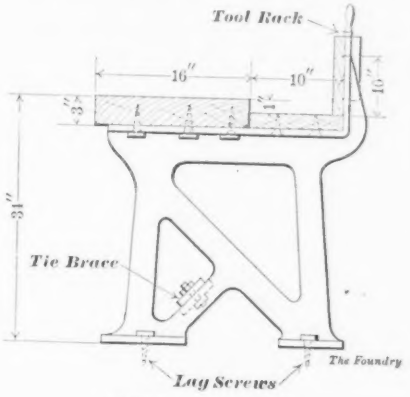
It is not necessary to dwell on the fact that trimmers are necessary. The only question is "How many?" There should be at least two large trimmers for general work and one of medium size located conveniently for use by the workmen occupying each pair of benches.

Many patternmakers prefer to make

their own wooden dowel pins, and in this case a dowel pin machine should be included with a capacity for making pins varying in diameter by ⅛ of an inch from ¼ inch to 1¼ inches in diameter. There are several other tools necessary, such as an emery grinder for sharpening gouges, a grind stone, or water emery wheel, for other tools, etc., but these devices are so well known that no description of them is necessary.

Benches.

The benches should be uniform in size, say, about 26 inches in width, eight feet in length and 34 inches in height. The top of the bench should be supported by rigid cast iron supports or legs. These



SECTION OF BENCH.

supports should be made with a bracket extending upward at the back, to which is secured the material forming the back of the bench and the tool rack which extends the entire length of the bench. This construction is shown in the accompanying illustration.

The working surface of the bench should be a 3-inch plank 16 inches wide, and the balance of the upper surface may be of 1-inch stuff so that it will be lower than the working surface, thus allowing the front portion of the bench to be dressed off with a plane at any time. The legs or supports should be attached some distance from the ends of the bench, so as to prevent any sagging at the center.

The bench should be equipped with a quick-acting universal vise and provided with a good spacious drawer, also with a set of bench stops. If the benches are placed along the wall, ample space should be left between them to receive the workmen's tool chests.

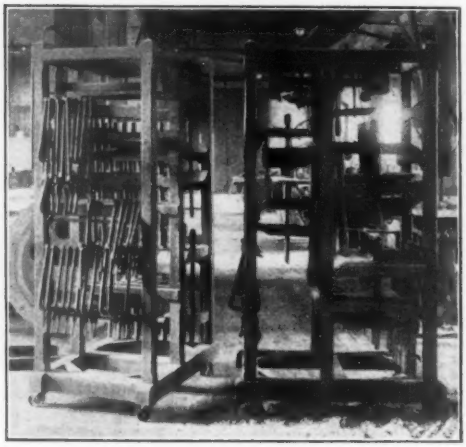
Parallel with each bench should be placed a work table and these should be of uniform height. A convenient size is 24 inches in height, eight feet long and four feet wide. By having the tables all of the same height, several of them can be moved together to support a large pattern when the construction of such work becomes necessary.

A large cast iron surface plate should be provided for building and testing work. A convenient size is four feet, three inches, by 10 feet. The outside edge should be surrounded by flanges nine inches deep, and the central portion of the plate supported by heavy ribs. The upper surface and the outer face of the flanges should be planed true and the vertical surface squared with the horizontal. The plate should be set level, so that work may be adjusted upon it with a spirit level. Parallel lines should be cut across the face plate while it is being made. Some prefer to have these 12 inches apart, while others prefer to have them three inches from each other.

A very handy piece of pattern shop equipment is a portable clamp rack, which is constructed to hold the various sizes of wood parallel clamps and also the iron clamps. Two of these racks are shown in one of the accompanying illustrations, and it will be noticed that they are mounted on casters, so that they can be wheeled to any part of the shop. There is very little about a pattern shop that is more unsightly than a lot of pegs nailed to the wall for supporting clamps. It is also exceedingly inconvenient to have to hunt over all the pegs and under all the benches for clamps when a man has to glue up a job. A rack of this kind will soon pay for itself in the saving in time effected in glueing up stock, on account of the fact that the clamps are always at hand.

For keeping track of the time spent on various jobs it is handy to use a regular Rochester time clock. This is independent of the clock used for keeping track of the total time which a man works. The same clock may be used

for ringing up both sets of cards, but the cards for keeping track of the work should be of a different color. They should be provided with columns for afternoon and forenoon, and also a column for overtime. When a man is given a job he is given a card and rings it up in the clock immediately. This card is then rung up at night and morning or at such times as ordinary cards are, until the job is finished. If a man has several



CLAMP RACK.

short jobs in a day the sum of the time of the job cards should correspond with the time on his regular time card. If it does not, it shows neglect on the part of some one. Either a new job was not ready for him when his previous work was completed, or the workman neglected to ring up the job card immediately upon receiving it. In figuring the cost of work these job cards will be found very useful.

Practically the same results can be achieved by the use of one of the special forms of dating stamps, preferably a form which calculates and stamps the time when set to the beginning and finishing periods for the job. The advantage of the system first mentioned is that the Rochester time clock is very often used for keeping the men's time, and hence to put in use the time keeping system for work, all that is necessary is to provide the additional set of cards.

APPENDIX.

One of the members of the club, who always sees the humorous side of a subject, has contributed the following appendix to the paper:

The foregoing was dreamed by a patternmaker one night and he felt so pleased and contented as he imagined that he had all these devices at hand that he felt very much disturbed when his wife called up to him and said that if he was going to work he better get up, for he was already behind his time. He replied, "Oh, that's nothing, for the shop is behind the times, too." After a hasty breakfast, he went to work, and this is what he found.

Instead of a large, rectangular, well lighted and well ventilated room on the ground floor, with its 18-foot ceiling and no columns, he had to make his way up a rickety stairway (that was good enough today on account of the fact that it was good enough for the pattern shop twenty-five years ago) to the third floor next the roof. Here he found a dingy room, with small windows and a ceiling from ten to twelve feet high, the height being determined by the pitch of the graveled roof. There were heavy wooden columns about twelve feet apart, to support the roof, and incidentally to get in the way of anything that was being done in the shape of a large pattern.

To one of these columns was attached a post lathe, which was so constructed that when it was necessary to turn any job of more than six feet in diameter, the pattermaker literally took his life in his hands when he applied his tool to the work, because of the general shakiness of the floor and the building.

For the other equipment he had a fairly good lathe, which however, lacked all the modern fixings, such as slide rest, taper feed, cross feed, or any other of the handy appliances. In operating this lathe, he had to depend on the best skill of a good mechanic to finish a good job in good time in the old fashioned way.

Tucked away off in the corner, you could by looking close, in case the day

was not too dark, or by turning on the artificial light, see a jig saw and a Daniels planer. The appearance and condition of the latter tool would make you wonder if this was not the same Daniel whose name it bears and who, according to history and fame, spent such a pleasant night with the lions in their den. (Please note that we do not mean the den of social lions of today.) The patternmaker could not help but wish that this machine was in the hands of its original inventor and that in place thereof he had that modern 24-inch joiner and 24-inch surface planer. There would be plenty of room for them because they would not take up more floor space than the relic of by-gone ages.

There is one other machine in this noted equipment which we must not forget, and that is the old fashioned ripsaw, with a wooden table, and which you raise or lower to regulate the depth of cutting by means of a single screw. In other words, the whole table rests at one end upon a half-inch bolt and at the other is secured by two strap hinges. Just imagine these hinges with loose pins and then consider what accurate work can be done on it. But you know that you have a rip saw which, by a little ingenuity on your own part, can be made to do cross cutting, so you were told by the management that you had no need for a modern, up-to-date rip and cross cut saw, with its tilting table, indicators and other devices for getting out work quickly and accurately. You know that this is so, or at least you are told so, because you have been using these tools for years and your predecessors for more years than you care to tell about.

With these tools you have to compete with the pattern shop of your dream, which unfortunately is realized at your competitors' works. This means that nothing in the world but muscle and hard work can make any showing.

This is no exaggeration, as several of the members of the club have seen the shop and can testify to the truth of the statements, or tell of others quite as bad.

We are pleased to note a tendency today on the part of many manufacturers and shop superintendents to give more attention to the details and requirements of the pattern shop, to its location in regard to other buildings, to the building itself, and to the tools and machines with which it is supplied; also to the arrangement of the latter. We can, however, all point to a number of shops that should be remodeled on these lines and equipped throughout with modern equipment before they can be called up-to-date. For instance, we can all tell of the building which is so surrounded by others that one must conclude that in the making of patterns, light instead of being the first requirement is considered the last, unless it be that the manufacturers consider electric light cheaper than daylight, even if it is hard on the workmen's eyes.

In the matter of placing of machinery, we have known of a large lathe which, on account of the position of the existing line shaft, was so placed that all the light for the workman had to shine through his job. Now, we all know that wood of sufficient thickness for making patterns is somewhat opaque.

These and other examples of the lack of forethought in studying the requirements of a pattern shop could be multiplied from the experiences of the patternmakers present. We all know that the pattern making machinery runs at a high speed and in the course of years must get out of condition, but we also know how hard it is to get it repaired. It must be that the patternmaker foreman is a poor kicker or that these conditions are so common that custom makes us put up with them without grumbling to anybody except ourselves. We think, however, that it is time to kick for the very best that can be obtained and then look for results in the out-put of work from any body of patternmakers, large or small.

We hope that this paper will lead some of those who are responsible for the troubles of the patternmaker to see to it that their patternshop shall be as near up-to-date as it is possible to

make it, believing that the ends attained will more than justify the expense in all cases.

CONVENTION NOTES.

Mr. Justus Thorner, vice president of the S. Obermayer Co., is as good a story teller as ever attended a convention and his track could be traced through the crowds at the Hollenden by the peals of laughter which greeted his humorous stories.

On the trip to Luna park Mr. T. E. Malone, of the J. S. McCormick Co., set a new style in straw hats, as he appeared with one a trifle larger than a silver dollar and wore it the entire evening. The night of the smoker the same little hat found a resting place on Mr. West's head.

Pneumatic Smith (C. T. Smith), of the Chicago Pneumatic Tool Co., ran out of compressed air at Lorain, could not catch the return boat, and had to ride back in a hay wagon.

Jimmie Smith, the feather man of the last convention, of the J. D. Smith Foundry Supply Co., failed to show up with his feathers, tomahawk and blanket, as he had promised, but his friends are willing to forgive him, as he was exceedingly busy looking after their entertainment. Jimmie is known locally as Plumbago Smith.

Mr. P. M. Baumgardner, of the Holland Linseed Oil Co., entertained some of his friends during the convention in royal style.

Mr. E. D. Frohman, of the S. Obermayer Co., helped out the local entertainment committee in a very acceptable manner by assisting in the entertainment of the visiting ladies.

Sand Smith (Wm. Smith), of the Standard Sand & Machine Co., was busy distributing souvenir pocket books.

John Hill, of the Hill & Griffith Co., was on hand, jovial and happy as usual, meeting old friends and making new ones.

The Deacon, of the Detroit Foundry Supply Co., spent his time looking after the friends of the company, while Woodison was pushing his pencil to get information for *The Blast*.

The S. Obermayer Co. was very well represented at the convention by Mr. Justus Thorner, from Cincinnati, who was accompanied by his wife and daughter; also by Mr. Fred J. Brunner, from Cincinnati, and by Mr. Adams, from Milwaukee, who was accompanied by his wife. Mrs. Adams, by the way, has sold a large number of orders of facing and blacking in the past, when her husband was absent from home on business trips and she found that the local foundries were in need of supplies. Mr. E. D. Frohman was present from Pittsburg and Mr. S. T. Johnston from Chicago, to represent the equipment end of the firm.

Uncle Billy (W. Chambers), of the Garden City Sand Co., Chicago, Ill., established headquarters in Parlor J of the Hollenden hotel, where he entertained his friends.

Frederic B. Stevens, of Detroit, Mich., was represented by G. F. Crivel and Wm. M. Wilson. Mr. Wilson's familiarity with Cleveland enabled him to be especially useful in entertaining visitors.

Mr. J. W. Cummings, of the U. S. Graphite Co., certainly made a mark at the convention by giving away several gross of excellent lead pencils.

While Mr. E. A. Dempwolf, of E. A. Dempwolf & Sons, York, Pa., is not one of the 57, he is still in the pickle business and can tell you all about hydrofluoric acid for pickling castings.

R. Ditty, of the Buckeye Milling Co., Cleveland, O., was so busy showing his friends about town that he had but little time to devote to the exhibit itself.

While Mr. Henry E. Pridmore did not have an exhibit at the convention he was nevertheless well represented by the two heavy weights, Henry E. himself and D. F. Eagan, and we predict that in the future he will be still better represented when the foundrymen throughout the country smoke up with those new pipes mentioned among the souvenirs, one of which Mr. Pridmore is exceedingly anxious that every

foundryman who attended the convention should possess.

Many of the foundrymen missed the well-known face of J. T. Wilkins, of the Connersville Blower Co., but those who visited its exhibit found Mr. R. T. Huston, who was in charge of it, thoroughly acquainted with blower problems.

The only sand man who stayed strictly on the job in the armory and also on the water wagon was Mr. U. E. Kanavel, and so as to keep the crowd with him on the aforesaid water wagon Mr. Kanavel had installed two water coolers, provided with mineral water, for the benefit of those who visited the Interstate Sand Co.'s exhibit and as some of the convention days were exceedingly hot we predict that this courtesy will long be remembered and the name of the Interstate Sand Co. will not be forgotten by those who shared its hospitality.

Mr. Jas. N. Norton, of the Monarch Engineering & Mfg. Co., of Baltimore, Md., was exceedingly busy taking care of two exhibits, one at the convention hall and the other at the office of the Natural Gas Co.

Mr. Wm. Oberhelman, of the Hill & Griffith Co., was able to introduce a great many of his southern friends to other foundrymen and his broad acquaintance made him of especial value to the entertainment committee.

The B. F. Sturtevant Co., was especially fortunate in having Mr. W. H. Coleman, its Chicago representative, at its exhibit, as Mr. Coleman has made a specialty of fans and blowers for cupola furnaces and was able to answer all questions asked him in a satisfactory manner.

F. N. Perkins, of the Arcade Mfg. Co., had one of the busiest exhibits at the convention, and while he shipped his machines from further west than any other exhibitor, they were both sold in Cleveland, which speaks well for the display.

The Tabor Mfg. Co. was remarkably well represented by its president, Wilfred Lewis, its molding machine salesmen, Messrs. A. J. Goss, J. W. Dopp, and G. E. Melville, while the Taylor-Newbold saw was represented by Messrs. Sidney Newbold and Lane Scofield.

One day when the exhibit hall was quiet and the exhibits still for a few minutes, every one was surprised by the appearance of a large hurdy gurdy wagon or street grind organ from which the horse had been removed, and which a number of willing hands were drawing through the exhibit hall. W. C. Sly, with his dogs, occupied the seat of honor in front, while C. T. Smith passed the hat and received a heterogeneous collection to reward their combined efforts.

FLUXES IN THE CUPOLA.*

BY N. W. SHED, BUFFALO, N. Y.

The value of fluxes in the cupola is not generally appreciated by foundrymen. Hundreds of cupolas are not slagged at all and the cinder dumps show an immense amount of iron actually wasted.

Not only is iron lost by the large amount combined with the cinder but the more or less infusible cinder encloses small masses and shots of iron which cannot be separated. It is a fact that the cinder dumps of many foundries contain more iron than many workable deposits of iron ore and if these accumulations could be gotten by the German blast furnaces they would be quickly utilized.

Another value of fluxes is their cleansing action on the cupola. A well slagged cupola has no hanging masses of iron and cinder which require laborious chipping out. The time and labor saved in consequence is an item that is well worth considering. In the running of heavy tonnage from a single cupola fluxes are indispensable. It would be well nigh impossible to run large heats in the same cupolas without using a good flux.

The value of fluxes being generally admitted the question arises, what flux is best to use, and how much?

There are two available fluxes for the cupola, these are limestone and

*Read at the A. F. A. Convention, Cleveland, June, '06.

fluorspar. Fluorspar is much advertised as a flux and the promoters claim that it gives marvellous properties to the iron. The glowing advertisements have evidently deceived the U. S. Geological Survey, for the reports of the survey speak of its great use and value in foundry practice.

The practical tests of fluorspar made by the writer showed it to be an inferior flux, it did not remove sulphur and the properties of the iron were not improved in the least by its use.

There is no doubt of the value of fluorspar in certain branches of metallurgy but the writer has failed to find a single supporter of its value in the foundry.

Limestone is far cheaper than fluorspar and far better as a flux. It makes little difference what form the limestone has so long as it is pure. It may be marble, soft limestone, hard limestone, oyster shells or mussel shells but it must be good. A limestone containing over three per cent of silica is poor stuff and one containing any considerable amount of clay should be rejected.

There should be at least 51 per cent of lime present. The sulphur should be below one per cent to two per cent. The phosphorus is not important. A magnesian limestone would do as well as ordinary limestone for the cupola. The amount of limestone to be used is variable, depending first, on the amount of silica in the coke ash. Second, on the amount of silica or sand adhering to the pig or scrap. And third, on the amount of silica to be carried by the slag.

The amount of limestone required to flux the coke ash can be figured according to the ordinary method of calculating blast furnace charges. The amount of sand on the pig and scrap is so variable that it is difficult to know just the additional amount of limestone to add.

The most practical slag and easily fusible slag has been found to be a monosilicate which means having equal amounts of silica and alkaline bases. Having these three variables in mind we find it a good rule to figure the limestone on the weight of the coke, using 25 per cent limestone. For example, if the charge of coke on the bed is 4,000 lbs., we use 1,000 lbs. of limestone. The next charge of coke is 1,000 lbs., we would use 250 lbs. of limestone. This amount of limestone will flux any ordinary coke ash with the average amount of sand on pig and scrap. If we know the amount of sand on the pig to be excessive we figure 30 per cent limestone on the weight of the coke.

With a low coke ash, machine pig and clean scrap the limestone may be reduced to 20 per cent and make a good cinder.

Many foundrymen are afraid to use limestone, fearing some injury to the iron. This is a superstition for the lime has no effect on the iron. There is usually a slight reduction in the amount of sulphur but owing to the great amount of iron present the iron absorbs a large amount of sulphur from the coke.

If more than 30 per cent is required to make a good cinder and clear the cupola it is evident that either the coke is very high in ash, or else the limestone is high in silica. In the latter case a large amount of lime is used in fluxing its own silica.

On account of the frequent variations in the stock it is a good plan to have coke, limestone and cinder analyzed occasionally. The cinder usually tells about the condition of the furnace. A light brown indicates a small amount of iron and the iron unoxidized. A black cinder usually indicates a large amount of iron and some oxidation. A shiny metallic lustre shows an excess of oxide of iron due to over blowing or lack of coke. Practically all the lime cinders from a cupola are glossy in appearance while the cinders with no lime are usually dull and earthy.

Occasionally a cinder is found full of bubbles, the color is usually black and shots of iron are found through the frothy slag. This is called foaming cinder and is made when the last few charges are at the bottom of the cupola. This cinder often rises to the

charging door and flows out over the floor. The iron cast at this time is hard and is low in manganese, silicon and carbon. With the foaming slag a dense smoke of reddish brown color pours out of the stack.

Analysis of this foaming slag shows the iron to be in an oxidized condition and in large amount. Sometimes the iron will run to 30 per cent in a frothy cinder, sometimes only to 12 per cent. The oxidized cinder and the red smoke show that iron is being rapidly burned in the cupola and the action going on is very much like the action in a Bessemer converter when it is tilted a little and blown to gain heat by burning the iron. The cinder is oxidized and the red smoke is produced in the same way. In both cases the iron is burnt to oxide which is quickly taken by the slag. The oxygen in the slag acts upon the carbon of the iron forming a large amount of carbonic oxide which rises through the cinder blowing it to a frothy condition.

There are two ways of avoiding this troublesome condition. If possible reduce the blast. If blast cannot be reduced add more coke. The presence of a good body of coke will stop the burning of the iron and the frothing does not take place.

In some cases the loss of silicon is very serious and to insure good castings it is necessary to add crushed silicon metal and ferro-manganese to the stream of iron as it runs from the spout.

Analyses of cupola slags where no flux is used show from 14 to 28 per cent. These slags contain two per cent to four per cent of shot iron mingled with the cinder. This proves that some of the iron must be lost in order to flux the coke ash and sand.

If we need limestone as a flux the amount of iron in the cinder is rarely over three per cent showing that the lime fluxes the ash and sand leaving the iron for the ladle. And the question is simply whether we will use iron as a flux at $18 per ton or limestone at $1.50 per ton? Another point in favor of the limestone is the clean cupola mentioned in the first part of this paper.

Following will be found an analysis of cupola cinder using lime compared with an analysis of cinder without lime:

	Using Lime.		Without Lime.
Ca O	34.60	Ca O	6.60
Fe O	4.10	Fe O	21.76
$Al_2 O_3$	11.02	$Al_2 O_3$	11.80
Si O_2	48.20	Si O_2	58.44
Mn O	1.40	Mn O	1.30
S	.20	S	.10
	99.52		100.00

TRADE PUBLICATIONS.

There was a time when the foundryman was not interested in machine tools, but with the advent of the modern steel foundry and also in the manufacture of many classes of heavy castings which require some machining, many foundrymen have found it necessary to install machines for this purpose. The machines usually employed for this class of work in the foundry belong to the heavy milling machine type. One of the most complete lines of these machines manufactured is described in a standard size catalog, 6 x 9 inches, entitled "Heavy Milling Machines Exclusively." This catalog is issued by the Ingersoll Milling Machine Co., Rockford, Ill. Many types of machines and cutters are illustrated and described in the 66 pages of the publication.

The Waterbury Crucible Co., of Waterbury, Conn., is sending out a catalog 6⅞ x 4⅛, describing the Waterbury crucibles and showing some views in the factory where they are made. The catalog is a remarkably neat example of the printer's skill, and is also well and clearly written. The only criticism which we have to offer is that we cannot understand why the manufacturers persist in using odd size catalogs which do not fit anybody's files, when the standard sizes are so much handier.

THE BENEFICIAL EFFECTS OF ADDING HIGH GRADE FERRO-SILICON TO CAST IRON.[1]

BY ALEXANDER E. OUTERBRIDGE JR.

The conjurer's familiar trick of pouring a number of different liquids, such as milk and water (not combined), red ink, black ink, claret and sometimes even stronger liquids, from one bottle in any order named by his audience, is a never failing wonder and surprise to juveniles and even to children of larger growth.

A less sensational, but far more practical problem has long engaged the attention of metallurgists, viz.: how to economically obtain from one cupola, in one heat, a variety of grades of molten iron suitable for different kinds of castings ranging, let us suppose, from those requiring high chilling iron such as chilled cast iron car wheels, or, from castings of high tensile and transverse strength, to small castings requiring extreme softness and ductility, in which great strength is not looked for. The wide variations in physical properties of cast iron are due to two combined causes, chemical composition and rate of cooling from the liquid state. Strength and softness are antagonistic qualities rarely found united.

Good car wheel iron is a strong metal containing less than one per cent of silicon, having nearly one-half of its carbon chemically combined. Stove plate iron is a weak metal containing about three per cent of silicon and very little, if any, combined carbon. Car wheel iron would be entirely unsuitable for stove plates, while stove plate iron would be useless for car wheels. Again, the metal which would be adapted to cast iron turn tables for large locomotives, or the iron intended for bed plates of heavy machinery and the like would not be suitable for either of the foregoing purposes.

It is the universal custom therefore, to pour car wheels from special mixtures having suitable chilling properties, and stove plates are poured from entirely different mixtures in different cupolas, and have but little chilling properties, but the modern metallurgist or general practitioner is daily called upon to provide metal melted in one cupola and one heat, suitable for a great variety of castings and requiring, if the best results are desired, wide variations in physical properties as well as chemical constituents. The method adopted by the author many years ago and which is, no doubt, practiced by others to meet these varying requirements in a thoroughly practical manner, has been to group all the small work for the day, needing soft ductile iron, so that it will be cast at the beginning, or near the beginning, of the run of iron from the cupola, which is, of course, charged with the required amount of the softest grades of iron; the proportion of silicon in such mixtures approximating 2½ per cent. This is followed by a medium grade of iron, calculated to contain about 1.9 per cent silicon, giving a product suitable for miscellaneous castings of medium weight and thickness, and capable of being machined readily, but not too soft to give good wearing service; this, again, is followed by strong iron mixtures intended for large and heavy work requiring close grained texture and usually high tensile and transverse strength. The strong iron may have as little as one half of one per cent of silicon and may possess high chilling property. The transverse strength of the soft iron (2½ per cent silicon) when cast in bars one inch square section and fifteen inches long, broken in the middle with supports 12 inches apart one ranges from about 1,900 pounds to about 2,200 pounds and the tensile strength per square inch of the same bars, when turned and pulled on a machine, having automatically adjusted grips to insure a perfectly straight pull while the piece is being strained, averages ten times the transverse stress, or, 19,000 to 22,000 pounds per square inch.

The medium iron (1.9 per cent silicon) averages 2,500 pounds transverse strength and 25,000 pounds tensile strength per square inch cast in the same size bars

[1] Paper read before the American Foundrymen's Association, Cleveland, June, '06.

and tested under the same conditions. The strong iron should exceed 3,000 pounds transverse strength and 30,000 pounds tensile strength of the same bars in the regular daily work.

"Special castings" have been made in the foundry of William Sellers & Co., Incorporated, (where the author has been engaged for nearly 20 years as metallurgist) which have united the two antagonistic properties of high tensile strength with softness and ductility in a remarkable degree. Tensile tests of bars ½ inch square section (being the same thickness as the castings) formed in the same mold with the castings and attached thereto, have shown, when turned and pulled on the 100,000-pound Emery hydraulic testing machine, extraordinary tensile strength, viz: 40,535 pounds to 44,565 pounds per square inch. These are believed to be the highest records ever noted for soft cast iron, if indeed they are not the highest for any kind of cast iron melted in a cupola.

It is of course impracticable to obtain a perfectly sharp dividing line between the soft iron, medium iron, and strong iron charged in a cupola and in the molten metal withdrawn therefrom, for it is impossible to prevent a portion of the product, if the composition is varied during the charging of the cupola from being to a certain degree variable, so as not to be accurately predictable as to its composition and physical properties in individual taps at the time when the metal is tapering off from one grade to another.

To overcome this uncertainty it is customary, in the foundry already named, to arrange the daily work so as to have a certain number of castings serve as "buffers," i. e., to take iron that is intermediate between the different grades charged in the furnace, and this method has proved very satisfactory. The buffers are usually castings that require but little machining and in which a considerable variation of composition of the metal is permissible. There are always plenty of such castings made in every foundry each day.

To supplement this routine method by a simple and cheap process of varying the chemical constituents and physical properties of molten iron after it has been tapped from the cupola and removed from the source of heat, is a desideratum devoutly to be wished for, and many efforts have been made to perform the trick. The prime difficulty is found in the fact that the melting point of cast iron is lower than that of nearly all of the metals or metalloids that are suitable for the purpose. For example, the addition of wrought iron or steel to cast iron increases its strength and chilling properties. It is a common practice to add steel in the cupola for this purpose, but, if the attempt be made to incorporate steel or wrought iron in the form of chips or small pieces in a ladle of molten iron withdrawn from the source of heat supply, it will be found unsatisfactory, for the reason that the melting point of steel is too high to permit of a sufficient amount of it to be dissolved in and diffused throughout the molten iron to effect a radical change in physical property without causing dull iron to result therefrom.

The element silicon is practically the governor that determines the degree of hardness of cast iron, therefore the value of a single and inexpensive process that would enable the intelligent founder to control the proportion of silicon in any individual ladle of molten iron drawn from the melting furnace would be at once apparent, especially in foundries where miscellaneous castings, ranging in size from small pulleys, with rims one-quarter inch thick, bed plates for various machines, hydraulic cylinders and the like, sometimes weighing many tons and of various thickness, up to a foot or more as is the daily practice in many foundries.

In the year 1886 the author made many experiments in this direction, using the richest grades of ferro-silicon then obtainable, containing from 10 per cent up to 18 per cent of silicon, by adding the alloy in small lumps or in powder to ladles of molten iron, but found that the metal would not dissolve a sufficient quantity of the alloy to greatly change the proportion of silicon and thus to produce a marked increase in softness of the iron without appreciably affecting the temperature and fluidity of the molten

iron. Preheating the alloy was the next logical step tried with an improved result, but it was soon ascertained that the inconvenience and cost of heating the alloy red hot would militate against its general usefulness. At the same time it was found that the addition of a small amount of ferro-manganese containing 80 per cent manganese (then a commercial product) accomplished the object sought in car wheel mixtures in a totally different manner by changing the condition of the carbon and without the necessity of heating the alloy. Therefore the tests with ferro-silicon were discontinued. In recent years electro-metallurgy has made giant strides and it is now possible to obtain commercially pure silicon (over 98 per cent pure) and ferro-silicon alloys of extreme richness ranging from 50 per cent to 80 per cent silicon or over. This fact caused the author to again take up the experiments of adding silicon to ladles of molten cast iron where he had left off in 1886. A quantity of 98 per cent silicon, made in an electric furnace at Niagara Falls, was obtained in large lumps. This material resembles in appearance 80 per cent ferro-manganese but is very much lighter in weight, bulk for bulk, the specific gravity being about one-third that of 80 per cent ferro-manganese and less than one-third that of cast iron. Many tests were made with this new material which resulted in failure, owing partly, no doubt, to the very high melting points of silicon (about the same as steel) and partly to its levity which caused the powder to float to the surface of the molten iron if sprinkled into the ladle, or to simply cake if fastened to the bottom. When an alloy of silicon and iron containing 50 per cent of silicon was used, however, a very different result was noted. This material was obtained in the form of coarse powder and was sprinkled into the molten iron as it was tapped into the ladle. Instantly the surface of the molten iron became "alive," as the workmen aptly expressed it; a rapid circulation of the skin of oxide which always forms on the surface was noticed, moving in circles like ripples from the center toward the edge of the ladle, this lively movement continued until the metal was poured and the same movement was noticed in the gates and risers of the castings. The usual test bars were poured both from the treated metal and from the same iron untreated. "Chill test pieces" were also poured into heavy iron cups, which serve by the extremely rapid cooling of the small chill test bars to magnify any chilling property just as a microscope magnifies any minute object. Few practical founders are aware of the fact that there is a very great difference in the chilling property of soft foundry irons, as the metal if poured in a sand mold, even in very thin section, does not show an appreciable chill, yet it does show the effect of such concealed chill under the machining operations of drilling, planing or milling, for the reason that particles of iron containing combined carbon may under such conditions be distributed throughout the castings, which are too minute to be seen by the naked eye, but destroy the cutting tools. The chill cup test is in effect a physical analysis of practical value which enables the foundry foreman to know the character of every ladle of iron, small or large, before he pours his metal. The little tapered bars poured in the cups become solidified immediately, are then turned out, cooled in a bucket of water and broken. Such tests are poured from every tap, broken at once and placed in a row for the foreman's inspection.

The chill cup tests of the treated and untreated iron in the foregoing experiment showed at once that the small amount of 50 per cent ferro-silicon added, viz: half a pound in a 200-pound ladle, had dissolved in the iron wiping out the chill in the metal almost completely. The regular transverse test bars when broken showed two very interesting features, one of which was anticipated, the other unexpected. The metal of the treated bars was much softer in appearance as was already indicated by the chill cup tests, but, instead of being weaker, the treated bars were *all stronger than the untreated bars.* In other words, increased softness and increased strength (too usually antagonistic properties) were here combined. The castings poured from the treated metal were small pulleys having rims about ¼-inch

thick that are ordinarily turned at a speed of 25 feet a minute. The treated pulleys were turned without destroying the cutting edge of the tool at 40 revolutions per minute as shown by memoranda furnished by the lathe operator.

RESULTS OF TESTS OF FERRO-SI IN LADLES.

Data	Remarks % Si	Breaking Strain (Pounds)	Deflection (Inches)	Resilience	Shrinkage (Inches)	% Gain		
						Break'g strain	Deflection	Resilience
Oct. 10, '05	¼ lb Hand	2265	.120	45.30	.192			
	Ladle	2157	.112	40.09	.191			
	Gain	110	.008	5.21		5.1 %	7.14 %	13. %
Oct. 11, '05	¼ lb Hand	2215	.137	50.51	.182			
	Ladle	2165	.124	44.60	.185			
	Gain	50	.013	5.91		2.3 %	10.4 %	13.2 %
Oct. 14, '05	¼ lb Hand	2600	.152	65.79	.196			
	Ladle	2055	.116	39.18	.188			
	Gain	545	.036	26.61		26.5 %	31. %	67. %
Oct. 15, '05	¼ lb Hand	2330	.143	55.45	.183			
	Ladle	1893	.110	34.60	.183			
	Gain	437	.033	20.85		23.3 %	30. %	60.2 %
Oct. 16, '05	¼ lb Hand	2210	.124	45.54	.183			
	Ladle	2120	.112	39.44	.185			
	Gain	90	.012	6.10		4.2 %	10.7 %	15.4 %
Nov. 13, '05	1 lb 200 lb	2370	.139	54.76	.186			
	Ladle	2050	.118	40.19	.184			
	Gain	320	.021	14.57		15.6 %	17.8 %	36.2 %
Nov. 21, '05	1 lb 200 lb	2178	.128	46.34	.188			
	Ladle	2000	.119	39.60	.182			
	Gain	178	.009	6.74		8.9 %	7.5 %	17. %

The success of these initial tests led at once to more extended investigations all corroborating the correctness of the first observations. Analysis showed that the actual increase in silicon was slightly less than the calculated increase, and further tests showed that there is a limit to the amount of the alloy that can be incorporated, depending upon the initial heat of the iron and the size of the ladle.

Another interesting observation is that a given increase of silicon, say one quarter of one per cent, imparted to molten iron in this manner is more effective as a softener than an equal increase of silicon imparted through the cupola in the charging of the iron, which any increase of silicon in the cupola always causes a corresponding decrease in strength of the metal. The rationale of the increase in strength with increased softness discovered in these tests is, in all probability, to be found in the deoxidation of the iron by the silicon added in its nascent condition. It is now quite generally believed that there is a small amount of oxide of iron dissolved in all iron melted in a cupola (notwithstanding the high percentage of free carbon) and that this oxide is a weakening element. Silicon has a strong affinity for oxygen and presumably seizes upon the oxygen of the dissolved iron oxide, liberating the iron, the silicon (oxide of silicon) thus formed having specific gravity of only 2.41 as compared with 7.15, the sp. gr. of cast iron, rises to the top, thus accounting for the two facts herein noted, viz:, the rapid circulation of the skin on the surface of the molten iron in the ladle, and the apparent slight loss of silicon when added in the alloy. The reason why an alloy of iron and silicon, rich in the latter element, dissolves and diffuses throughout the molten mass, while pure silicon will not, is probably owing partly to its relatively high specific gravity (over 6) and partly to the fact of already being alloyed with iron which melts and acts as a diffusing vehicle enabling the silicon to become incorporated with the molten

iron. The action is very similar in this respect to that of manganese in the 80 per cent ferro-manganese already spoken of.

Not desiring to extend this paper to undue length, details of many similar tests are omitted which, it may be said, have resulted in the practical adoption of this method of treating iron in the ladle in the foundry of Wm. Sellers & Co. Incorporated, as a ready and reliable means of producing very soft and at the same time strong iron for small castings from metal of medium grade which would not otherwise be so well adapted for the purpose.

The 50 per cent powdered ferro-silicon used costs about four cents per pound at the present time, but, as the quantity required to produce the desired result is so small, viz:, about half a pound, or less, to a hundred pounds of iron, the cost is really trifling, and is far more than counterbalanced by the fact that cheaper grades of pig iron may be used in the furnace. Added to this is the great practical value of being thus able to control the product absolutely and to vary the character of the metal in regard to softness, or machining quality, while at the same time increasing the strength and ductility of individual ladles of molten iron drawn from one common source.

The author's experiments in adding 80 per cent ferro-manganese to car-wheel iron in ladles in the year 1886 briefly alluded to have been thoroughly exploited years ago in technical journals and have been frequently mentioned by other writers. The process has come into large daily use and as its merits and limitations are familiar to all car-wheel makers and most metallurgists it is not considered necessary therefore to refer at length to the subject in this place.

Appended hereto is a small table of a few tests of treated and untreated bars of soft and medium grades of iron all showing gains in strength ranging from 2 3-10 per cent to 26½ per cent, and in deflection of the bars from 7 14-100 to 31 per cent, while the increase in softness was very marked indeed. It is hoped that these few records may prove interesting and valuable to founders.

A TALK ON ALLOYS.*

BY C. VICKERS, MILWAUKEE, WIS.

The metals most frequently alloyed with copper are: tin, zinc, and lead. Those less frequently used are: antimony, silicon, aluminum, manganese and nickel.

Alloys of copper with tin are known as bronzes. It is rarely, however, that copper and tin are used alone to form bronze, small quantities of zinc and lead being generally added for specific purposes, thus zinc promotes solidity, or freedom from blow holes while lead makes the alloy more easy to work. Bronze is the most useful of the alloys of copper for casting purposes, and in spite of the high price of tin, there are few founders who can dispense with it altogether.

Copper and zinc alloys are known as yellow brass, to the trade, the adjective yellow being prefixed to distinguish them from the bronzes, which are generally known by the term "red brass."

Yellow brass is largely used for casting purposes, in the making of plumbers' brass goods, gas and electric fixtures, hose couplings, nozzles and the like.

Zinc may be added to copper in much greater quantity than tin, and form a useful alloy. The limit of usefulness being equal parts of copper and zinc, which forms spelter solder.

When the zinc exceeds the copper the alloy rapidly whitens in color and becomes brittle and worthless at 65 per cent zinc, 35 per cent copper, one per cent aluminum. The alloy is a brilliant white metal which may be easily pulverized in a mortar.

All alloys of copper high in zinc are much improved in casting qualities by the addition of aluminum. When heated some of them become very plastic and can be worked into complex shapes. Externally they have a beautiful yellow color tinged with green, and when soiled, may be restored to their original beauty by heating to faint redness, and quenching in water.

An alloy of eleven parts copper, nine parts zinc, and one per cent

*Paper read before the A. F. A. at Cleveland, June, '06.

aluminum while externally of the yellow color mentioned, resembles red brass when cut into. It is a very rigid, and highly sonorous alloy.

The proportions above, must not be deviated from, however, otherwise in place of the high tensile alloy, we obtain an alloy, which, while pretty, is worthless when strength is required. It is characterized by a brilliant greenish yellow, crystalline fracture, and has the strength of cast zinc.

Alloys of copper and lead are known as pot metal. Such alloys are now obsolete, therefore, we will pass them by without further notice. Lead, however, is extensively used in copper alloys. A good bearing alloy being copper, 80 parts; tin, 10 parts; lead, 10 parts; lead is also used with zinc to form "red brass" proper. A typical red brass alloy is copper, 50 parts; lead, five parts; zinc, five parts; tin, two parts; this is a very useful alloy for small castings, as it may be easily machined.

The use of antimony in copper alloys is limited as it makes the alloy brittle. An alloy of copper, 10 parts; antimony, 2½ parts; is close gained, similar to bell metal and takes a high polish, but is very brittle. Copper, 20 parts; antimony, 2½ parts; is a red metal. A test bar one-half inch square, and twelve inches in length supported at each end, broke under a load of 140 pounds, applied at the center. Before breaking, it was deflected one inch from a straight line. An alloy of antimony, 3½ parts; zinc, 2¾ parts; is a close grained white alloy, useful only as a mixing alloy; it is so brittle it may be powdered with ease.

Two parts of this alloy were added to 16 parts of copper, a test bar of this metal one-half inch square and 12 inches between supports, under a weight of 140 pounds, was deflected two inches without breaking.

Castings of this alloy, come out of the sand coated with a white deposit, precisely as if heavily tinned, and on that account it is interesting.

Antimony can be used to harden copper, without materially changing its color. An alloy of copper, 10 parts; silicon copper, one-eighth part; Antimony, one-half part; is hard, tough, sonorous and useful for many purposes where a hardened copper is required.

Silicon is used in copper alloys as a deoxidizer; one pound of silicon copper will deoxidize 100 pounds of casting copper, and make perfectly solid castings, it is much better for this purpose than phosphorus, as the castings run clean and bright.

Copper aluminum alloys are difficult to cast; on this account they are not much used by brass founders, and the same may be said of manganese while nickel is used in German silver and other kindred white alloys. Of all metals used to alloy with copper, tin is by far the best; its place can be filled by no other metal. All alloys of a red color, in which tin is omitted or only used in small quantity, are imitation bronzes and resemble true bronze only in appearance. They have their own sphere of usefulness but can never take the place of bronze on heavy machinery.

THE LABORATORY EXAMINATION OF MOLDING SAND.*

BY PROF. HEINRICH RIES., CORNELL UNIVERSITY, ITHICA, N. Y.

In connection with the utilization of any kind of mineral product, whether of metallic or non-metallic character, it is usually desirable to have some means of testing its value in the laboratory, so as to avoid a more costly test on a practical scale, if the material appears unpromising.

As a result of this we have well developed methods for assaying ores, for determining the chemical composition and heating power of coals, the crushing strength of a building stone, or the refractoriness of a clay.

There are, however, some mineral products, of no mean importance, which seem to have been neglected in this respect, and in this class, needless to say, we are obliged to place the molding sands.

The materials employed for making molds and cores in casting iron, steel,

*Paper read before the A. F. A., Cleveland, June, '06.

TABLE II

Lab. No.	LOCALITY	20 Mesh %	40 Mesh %	60 Mesh %	80 Mesh %	100 Mesh %	100 Mesh[1] %	Clay	Fineness %	USES
35	Dye's Special, Ind.	.00	.06	.10	.04	.12	46.98	52.64	174	Malleable brass and gray iron.
8	Zanesville, Ohio	.10	.28	.56	.14	.36	46.64	51.70	163	
9	Albany, N. Y.	.00	.10	.20	.10	.20	71.22	28.16	143	
16	Zanesville, Ohio	.00	.16	.34	.12	.18	74.82	24.16	140	
43	Newport, Ky. (No. 5)	.00	.02	.04	.02	.14	77.54	22.12	140	Stove plate and brass.
52	New Albany, Ind.	.00	.10	.20	.10	.24	76.60	22.80	139	Malleable brass and gray iron, high grade stove plate.
57	Hamilton Co. O. (B. Y. No. 1)	.00	.10	.18	.06	.12	77.50	22.40	139	Stove and agricultural castings and brass.
55	Waterford, Ill. (No. 4 Grade)	.04	.06	.12	.06	.12	80.12	19.22	137	Malleable, gray iron and brass.
45	Newport, Ky. (No. 3)	.00	.06	.84	1.00	18.32	43.56	35.52	137	Light machinery and malleable castings.
32	Racine, Wis.	.00	.70	3.54	1.38	7.22	49.46	39.44	136	Small castings.
27	Rockton, Ill.	.00	1.12	10.68	1.86	6.82	46.38	32.86	134	Medium and heavy castings,
44	Newport, Ky. (No. 6)	.00	.00	.06	.06	.62	87.02	11.92	132	Ligh, stove plate and brass.
54	Waterford, Ill. (No. 3 Grade)	.04	.42	3.90	1.92	6.12	56.72	33.02	131	Malleable iron castings, agricultural implements.
35	Neenah, Wis.	.00	1.26	4.26	1.40	5.64	32.04	35.14	131	Medium.
31	Rockton, Ill.	.00	.90	2.30	.70	1.84	74.02	18.50	129	Light gray castings.
17	Berlin, Wis. (No. 3)	.00	.76	3.74	1.78	10.44	62.96	20.06	125	
34	Neenah, Wis.	.00	.56	1.8	2.12	1 00	61.74	30.66	121	Brass sand.
21	Altoona, Wis.	.44	2.82	5.76	1.44	2.86	51.96	33.46	119	Saw-mill casts, sleigh shoes, repair, and sash weights
51	St. Joe Riv. St. Joe Co. Mich.	.00	.54	11.68	2.78	16.58	43.42	24.52	110	Small gears, malleable iron, brass, car journals.
24	Berlin, Wis.	.00	1.46	9.78	3.52	14.86	47.48	22.86	109	
19	Berlin, Wis.	.00	1.76	10.44	4.50	14.52	45.42	20.64	106	
36	Menomonie, Wis.	.54	2.74	5.44	.82	3.74	76.86	9.16	106	
7	Berlin, Wis.	.00	.36	6.56	3.52	21.22	64.84	2.56	105	
49	Indiana (No. 1)	.04	.66	11.42	8.12	20.64	35.40	23.42	105	
28	Berlin, Wis.	.00	.54	8.50	5.34	19.14	60.64	4.80	103	
22	Grand Rapids, Mich.	.00	1.98	21.76	6.56	14.06	30.16	24.96	93	
37	Marinette, Wis.	2.08	3.68	12.06	4.26	9.22	39.14	29.10	92	
47	Indiana (No. 3)	.06	.62	18.76	9.02	23.48	33.26	12.82	92	Light machinery and malleable iron.
26	Neenah, Wis.	.00	2.02	20.78	7.32	15.96	38.70	14.84	90	
48	Indiana (No. 2)	.00	.94	18.18	8.54	29.96	34.22	7.94	88	Machinery sand.
29	Racine, Wis.	.00	1.04	11.74	5.80	28.48	46.08	6.60	86	Fine core sand.
23	La Crosse, Wis.	.54	7.72	13.00	1.94	8.34	49.76	18.10	86	
33	Racine, Wis.	.00	.72	24.68	11.78	26.60	19.20	16.30	86	Heavy castings.
56	Valparaiso, Ind.	.26	3.56	26.08	10.06	17.70	15.10	27.12	83	Large pipe, fittings and structural iron.
1	Berlin, Wis.	.10	3.26	23.82	8.32	26.04	37.32	1.02	83	Core sand.
4	Pardeeville, Wis.	.00	.36	23.76	9.50	35.76	30.22	.36	82	General work.
25	Janesville, Wis.	.00	4.00	28.72	8.48	22.54	21.22	14.84	78	Core sand.
20	Wheatland, Wis.	1.26	18.94	2.26	23.70	29.86	8.96	14.00	76	
6	Massillon, Ohio	3.40	1.36	12.52	11 98	39.16	24.66	6.50	74	Heavy castings.
15	Klondike, St. Charles Co. Mo.	.00	4.54	41.98	13.78	21.12	15.76	.66	73	
41	Janesville, Wis.	1.66	7.70	25.20	8.12	17.68	21.42	18.20	70	Heavy work.
11	Fairwater, Wis.	.00	4.86	34.46	8.06	29.38	22.58	.16	68	
12	Fairwater, Wis.	.00	7.76	32.82	7.24	30.06	21.96	.32	66	
50	Kenosha Co. Wis.	1.32	14.02	28.68	5.62	10 24	14.12	24.02	63	Heavy machine castings.
65	Milwaukee	3.56	5.47	28.41	10.61	27.76	22.75	Tr.	62	Core sand.
5	Pardeeville, Wis.	1.80	9.08	35.68	7.94	13.90	19.78	11.04	62	General work.
10	Pardeeville, Wis.	.00	5.92	42.00	11.64	22.58	12.76	5.06	62	General work
13		.00	.94	66.04	7.00	15.84	6.46	4.22	62	
2	Wheatland	5.99	9.18	21.80	5.86	8.81	13.72	27.36	58	
46	S. Milwaukee	6.90	11.44	27.76	8.76	14.10	12.47	18.52	54	
58	Illinois Steel Co.	.10	7.10	62.02	10.05	10.54	6.92	2.32	53	
40	Kerrick, Minn.	6.00	8.20	19.96	4.92	11.04	31.72	10.30	49	Green sand casting, general heavy work.
14	Ottawa, Ill.	.00	40.28	41.28	2.92	7.46	5.82	1.48	40	Steel castings.
30	Janesville, Wis.	.40	16.54	56.24	5.60	5.20	2.60	13.34	40	Cores and heavy work.
39	Madison, Wis.	11.66	21.98	43.82	7.50	9.02	4.12	1.66	39	
42	Superior, Wis.	12.76	35.06	40.56	5.72	3.24	1.54	.40	32	Pipe cores.

bronze, brass, etc., vary in character from a loamy clay to a sand or even gravel, being often, but not always of highly siliceous character.

For small castings, and for those on which it is desired to produce a smooth surface a fine sand is used, while for larger castings a coarser material is often employed.

Molding sands are not always used alone, and one or more grades are not infrequently mixed together, indeed the blending of molding sands is quite extensively practised now both at the pit and at the foundry. Even this, however, does not always give a mixture of exactly correct physical properties, and so certain foreign substances such as cinders, ground coal, graphite, molasses, flour, stale beer, linseed oil or straw are sometimes added either to increase the bonding power or permeability of the material. It is therefore seen that a sand in its natural condition may be deficient in certain qualities and yet by "doctoring" be greatly improved in quality.

The question may be reasonably asked whether it is possible to develope a set of standards to which molding sands used for different grades of work must conform. The problem is undoubtedly a difficult one, but still it may not prove as much so as one might expect.

If from a laboratory examination of a molding sand we can obtain at least some clues towards its possible applications, without having to go to the expense of time, labor, and material required for putting the sand through a practical test, much will be gained.

Unfortunately but little has been published on this subject in the past. Many books on foundry practice give but little attention to the value of a chemical analysis, although a few suggest that further chemical investigations would be desirable. A physical examination of the material is rarely referred to.

This lack of previous laboratory investigations might lead some to suppose that such methods were of little value, and even the foundryman in many cases looks on them with discouragement. Such action should however but serve as a stimulus to probe the matter more deeply, and not give up until it is definitely proven to be valueless.

In practical work the foundryman is accustomed to give a moist sand a preliminary examination by pressing it in his hand to see if the particles cohere, or to hold it between his hands and blow through it in order to test its permeability, and the acceptance or rejection of the sand sometimes hangs on this simple but insufficient test.

Even assuming however that laboratory standards for determining the uses of a sand are of little value, they might still have another application, viz., that of keeping check on the material being received from any one pit.

It is well known that the sand in any one deposit does not always run perfectly uniform in its character, or there may be carelessness in the sorting of the material from different beds in the bank. This may show up in the behavior of the material at the foundry. Now if each shipment is examined either physically or chemically, or both, variations can in most cases be detected, before any castings are spoiled. Of course a certain amount of variation is permissible, and even unavoidable, but it should not be increased by careless mining or mixing of the raw materials at the pit.

During the past year the writer has had occasion to make a study of some of the molding sands used in Wisconsin, and as a result of this work, he takes pleasure in offering a few facts to the Association in the hopes that they may at least provoke discussion, and bring out suggestions regarding possible methods of testing these materials in the laboratory.

As is well known the sands used for molding, can be separated into two groups, viz. those used for making the mold, into which the metal is poured, and those used for the core, which fills up hollow spaces.

Considering the molding sands as a class, we find that the requisite qualities usually mentioned are:

1. Proper texture.
2. Permeability.
3. Sufficiently long life.
4. Moderate refractoriness.
5. Sufficient bonding power.

Texture.—The texture of the sand or percentage of grains of different size is determined by a sieve test, this being done by passing the sand through a

series of sieves of decreasing mesh and and noting the percentage which remains on each sieve.

The sands may be sieved either dry or wet. If the sizing is done on dry sand, it is found that some clay particles adhere to the sand grains, and therefore the percentage of the several sizes is greater than it should be.

A method used by Mr. W. G. Scott of The J. I. Case Threshing Machine Co. of Racine, Wis., consists in placing ten grams of sand on the 100 mesh sieve, along with ten 7-16 in. steel ball-bearing balls, and shaking with a circular motion for one minute. The sand passing through is weighed and credited to the 100 mesh sieve. The sand remaining on the meshes of the sieve, together with the balls is emptied onto the 80 mesh sieve, the operation repeated, and so on up to the 20 mesh. With this method he claims less work is required and the results are more accurate.

The method adopted by the writer for the Wisconsin sands was as follows:

Fifty grams of the sand were put in an eight-ounce bottle, and the latter half filled with water. This mixture was then put in the shaker for four hours, after which it was washed through a set of 20, 40, 60, 80, and 100 mesh sieves. The sand retained on each was dried and weighed. That which passed through the 100 mesh was caught in a jar. When all the water and suspended matter had been run through the sieves the contents of the jar were stirred up, and after standing 45 seconds, the water with suspended clay and fine silt were decanted off. More water was added, the contents of the jar stirred and the decantation repeated. In this way two sizes were obtained. That which remained in suspension has been termed the clay and that which settled is indicated as 100+, and most of it is retainable on a 150-mesh sieve.

Some objection may be raised to shaking the material before sizing, because of its tendency to destroy some of the loosely cemented compound grains. It is probable, however, that in tamping the sand into the flask for casting, that many of these would be broken up. Those that are too hard to be thus crushed are likely also to resist disintergration in the shaker It was found, however, that several of the sands analyzed contained compound grains in the 20, 40 and even 60-mesh sieves.

In the work on the Wisconsin materials about fifty molding sands were analyzed mechanically, and the limits of variation of the different sizes are given in Table I.

TABLE I.

Size Mesh.	I Percent.	II Percent.	III Percent.
20	0 — .04	0 — 6.	0 —12.76
40	.02— .90	.16— 9.08	.72—35.06
60	.04—2.3	.34—42.00	19.96—56.24
80	.02—2.2	.12—11.64	4.92—11.78
100	.12—1.84	.18—39.16	3.24—30.06
100+	46.98—87.02	12.76—76.86	1.54—37.32
Clay	11.92—52.64	.36—35.52	.4 —18.26

I. Brass sands.
II. Sands for general work.
III. Core sands.

An examination of the above figures shows that the fineness of each group varies in two cases at least between rather wide limits, and as we might expect there is some overlapping. That is to say that some of the sands used for general work are coarser than some of the sands used for cores. This is however to be expected. No one grade of sand can be used for all kinds of castings. Considering the average fineness of each group however, we see that the brass sands are the finest, the sands for general work the next, while the core sands average the coarsest.

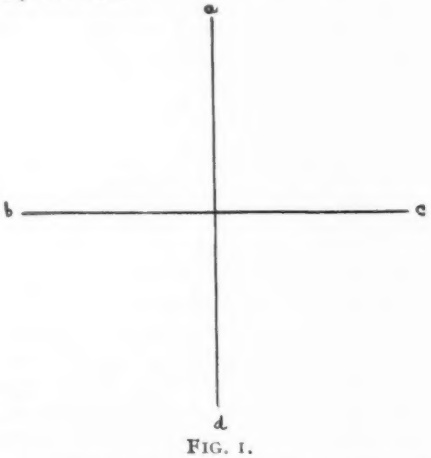


FIG. 1.

In Table II are given the mechanical analyses of all the sands examined, together with their fineness and uses.

While it is possible to use these analyses for purposes of comparison it is sometimes rather slow work where a large series of analyses are being considered. If therefore we can devise some graphical method of showing the texture such comparisons can be more rapidly and satisfactorily made.

Fig. 1. Represents the method adopted. On the four lines, a, b , c, d, there are laid off equal distances, corresponding to 100 per cent. On a, the percentage of clay is laid off, on b the amount of 100, on c the percentage of 100+, and on d the combined percentage of 20, 40, 60, and 80 mesh grains. These last four are combined as they represent the coarse particles of the sand. Having laid off the proportionate distances on the four lines, the points are connected by straight lines, and the resulting figure shows at a glance the structure of the sand.

Plates I, II, and III, represent the texture of all the sands examined, and includes several well known sands from Ohio, Indiana and Kentucky. In the very fine ones it will be noticed that most of the figure lies above the horizontal line bc, while in the very coarse ones they lie below the horizontal.

For example, in Plate I one can tell at a glance that Nos. 53 and 8 are practically identical, and that Nos. 45 and 32 are very closely alike.

Since the mechanical analysis is a rather detailed and lengthy mode of stating the texture of the sand, it is evident that if the fineness can be expressed by means of a single number it would be much more convenient. Such a number must however represent the average fineness of the sand.

This average may be defined as the sum of all the quantities considered divided by the number of separate items.*

Now if in a sand we have

N_1 grains of size S_1.

N_2 grains of size S_2.

N_3 grains of size S_3.

etc.

Then

$$\text{Average size of } S = \frac{N_1S_1 + N_2S_2 + N_3S_3 + }{N_1 + N_2 + N_3 + \text{ - - -}}$$

*The method of calculating the average fineness of a sand has been suggested to the writer by Professor J. S. Shearer of Cornell University.

If the total number of grains is N then

$$N_1 + N_2 + N_3 + \text{ - - - } = N$$

$$\text{And } S = \frac{N_1S_1 + N_2S_2 + N_3S_3 \text{ - - -}}{N}$$

$$\frac{N_1}{N}S_1 + \frac{N_2}{N}S_2 + \frac{N_3}{N}S_3 + \text{ - - -}$$

But $\frac{N_1}{N}$ the fractional part of the whole quantity which has a size S_1. So if the total number is taken as 100 (or proportional to 100) $\frac{N_1}{N}$ = per cent of size S_1 and $\frac{N_2}{N}$ = per cent of size S_2.

In order to apply this formula to the mechanical analysis of a sand it is necessary to assume an average size for each mesh. In the case of the grains retained on the 20 mesh, it was assumed that they averaged 1/15 in., as few of them were much larger. This size would then be expressed decimally as .066.

Those which rested on the 40 mesh, might range from 1/20 to 1/40 inch. and their average was taken as approximately $\frac{\frac{1}{20} + \frac{1}{40}}{2} = .037$ and so on. The average size grain of the 100 size was taken as $\frac{1}{100}$ in. or .008, while that of the silt as clay was assumed as .004.

As an example:

The mechanical analysis of one sand was:

Mesh.	Per Cent.
20	.44
30	2.82
60	5.76
80	1.44
100	2.86
100+	51.96
Clay	34.46
	99.94

.0044 x .066 = .00029
.0282 x .037 = .00104
.0576 x .019 = .00109
.0144 x .013 = .00019
.0286 x .011 = .00031
.5196 x .008 = .00415
.3446 x .004 = .00137

.00844 average grain size

$\frac{1}{.00844} = 118$ mesh.

In other words, if all of the grains of the sand whose mechanical analysis is

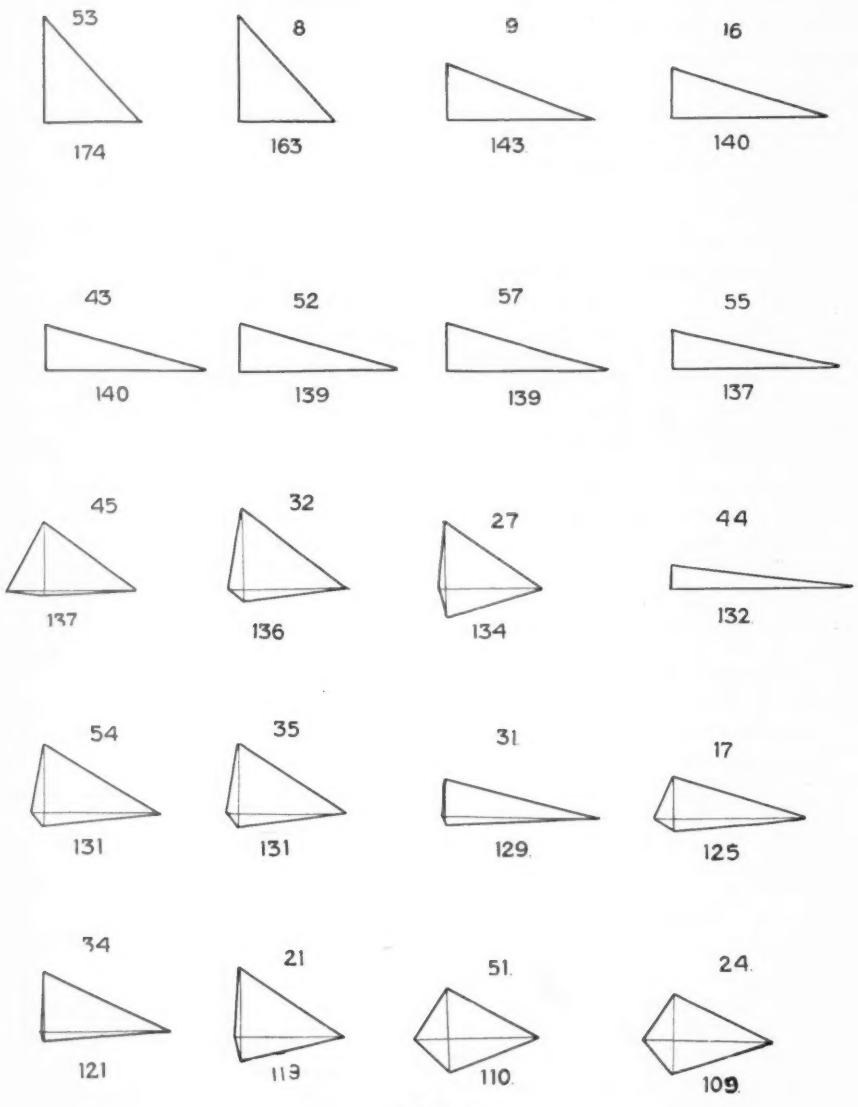


PLATE I.

given above were reduced to a uniform size, they would pass through a 74 mesh. The average fineness of the sand is given as 74.

It will be seen from an inspection of plates I and III that the average fineness of the sands examined ranged from 174 to 39.

Permeability and Porosity—By the permeability of the sand is meant the property which it possesses of allowing liquids or gases to filter through it, and Plates I and III that the average fineness it depends therefore on the size of the pores.

By porosity is meant the volume of pore space between the grains.

These two properties are therefore not the same. A sand may contain a few large openings through which liquids or gases might easily escape, and yet have a small total pore space. On the other hand its total pore space might be large, but owing to the small size of the pores permeability by either gases or liquids becomes difficult.

The permeability of a sand might be influenced by three things, named in the order of their probable importance:

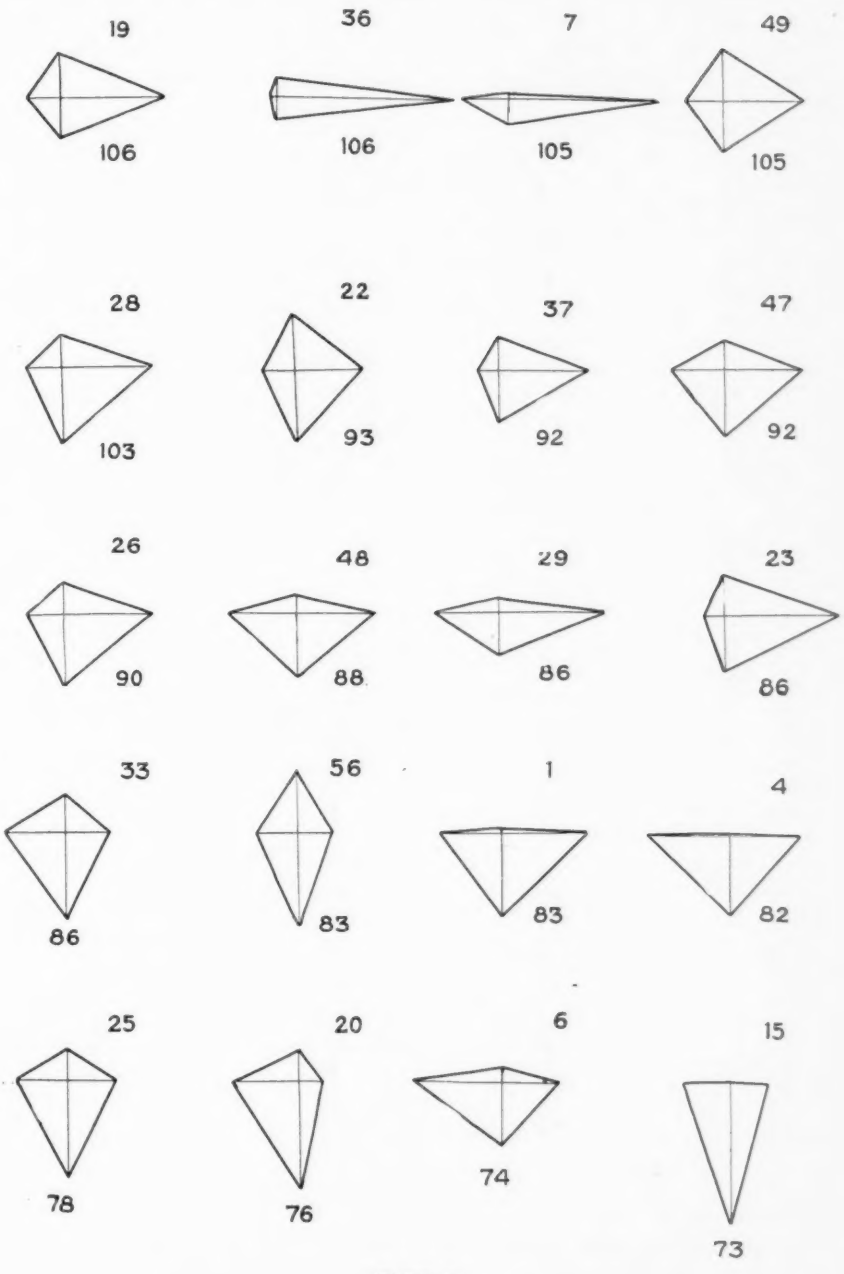


PLATE 2.

1. By the tightness of packing.
2. By the size of the grains.
3. By the fluxing elements of the sand.

In discussing the effect of 1. two cases must be considered, (a) that of a sand whose grains are all of the same size, and (b) that of a sand whose grains are of unequal size.

If a given amount of sand is placed in a cylinder it will occupy a varying volume of space depending on whether it is tightly or loosely pressed in, and the closeness of the packing may be increased by tapping the containing vessel. This gets the gains into their closest arrangement, producing the minimum pore space

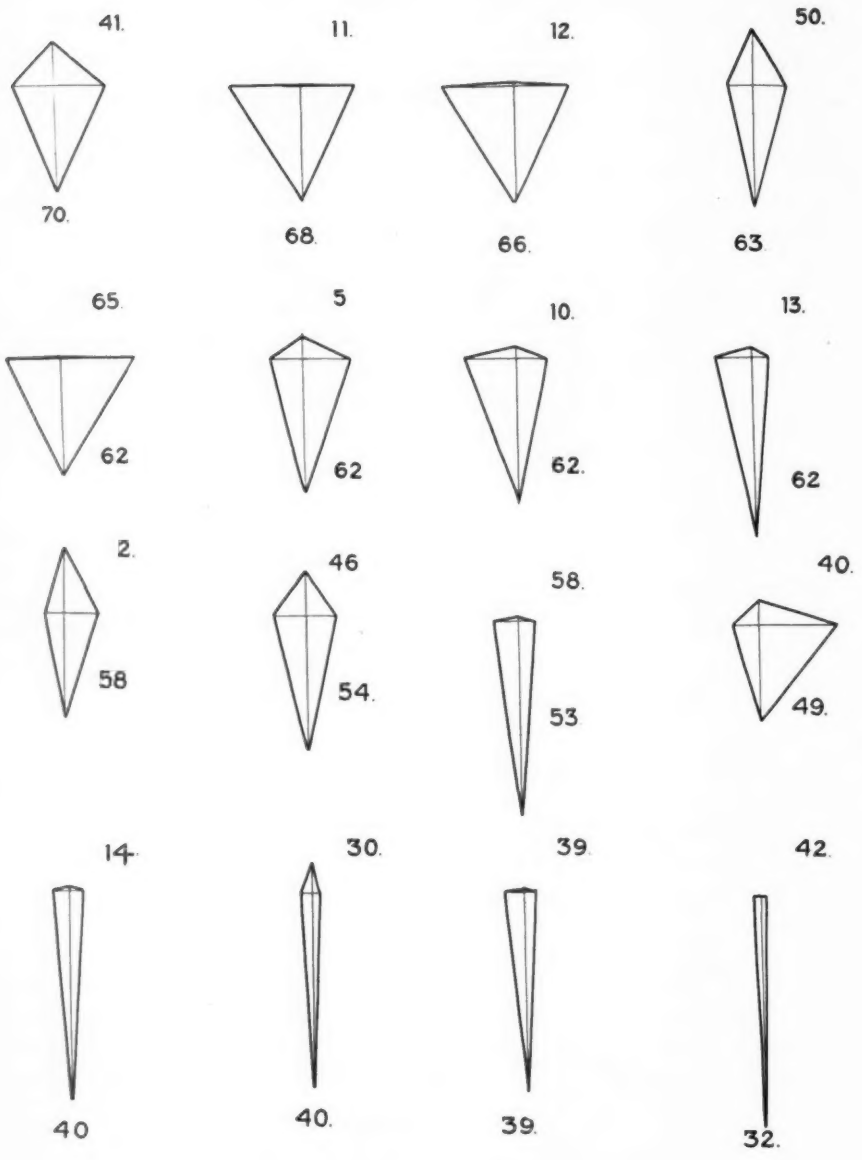


PLATE 3.

The amount of pore space produced in this manner however is dependent somewhat on the shape and size of the grains.

In order to make this clearer it is necessary to assume somewhat ideal conditions. An ideal sand would be one composed of spherical, uniformly sized grains, and the amount of porosity will be governed by the arrangement of the grains. Thus comparing Figs. 2 and 3, the most compact arrangement is that shown in Fig. 3, in which each grain touches 12 other grains (19th Ann. 11: 306, et. seq.), and in this case the pore space would equal 25.95 per cent. If however each sphere touches 6 others, the maximum pore space is developed, and equals 47.64 per cent.

It makes no difference, what the diameter of the spheres is, (provided these are all of the same size), the pore space will remain the same, with the same arrange-

ment. With smaller spheres however, the pores will be smaller, and hence the permeability less.

Such ideal sands are practically unknown in nature, but fine grained sands are more apt to approach theoretic porosities than the coarse grained ones.

In nature the conditions are quite different, and the sands commonly found contain not only grains of irregular size but sometimes of angular character.

The investigations of King* have shown that the finer grained sands have a larger pore space than coarser-grained ones, even though composed of approximately equi-sized grains, and that if the grains are angular, the pore space for any given size is increased because angular particles will not pack so well. The minimum pore space was obtained by using two sands of rounded grains but different diameters, and mixed in equal parts.

In connection with grain size, there is probably one factor which is lost sight of, and that is the state of aggregation of the finer grains of the sand, whether they be silt, or clay. If these are separate, they will pack much closer, and tighter, than if cemented or bunched together in the form of compound grains.

If in the latter condition the porosity of the mass would be larger, and the permeability also, than if the grains were separate. In the mechanical analysis of the sand the grains undergo some rubbing, and these compound grains may therefore be destroyed to some extent.

The above brief discussion of the porosity of sands is not of purely theoretic value, but has several important practical bearings, for from it we see the means of increasing or decreasing the porosity of the sand somewhat. Thus tamping, because of forcing the grains together decreases the pore space, but even so theoretic conditions can rarely be reached.

Other things being equal, sands of varisized grains pack closer than those of equi-sized grains.

The decrease in permeability under increased tamping explains why some good sands behave badly, when packed too tightly, in the mold, refusing to allow the gases to escape, and causing blowholes.

*19th Ann. U. S. G. S. 11:209-215.

The permeability of a sand is also influenced probably by the amount of water used in packing the sand. Foundrymen usually add a minimum quantity of water to the sand, in fact just enough to make it cohere sufficiently, it being claimed by some that an excess fills up the pores of the sand, and thereby decreases its permeability. While the addition of too much water may do this, the effect is probably an indirect one, and is due to the fact that wet sand will pack denser than dry sand. This closer packing will consequently decrease the pore space.

The relation between fluxing impurities and permeability is one which may show itself during the casting. If the clayey particles filling the interstices of the sand are sufficiently impure to fuse

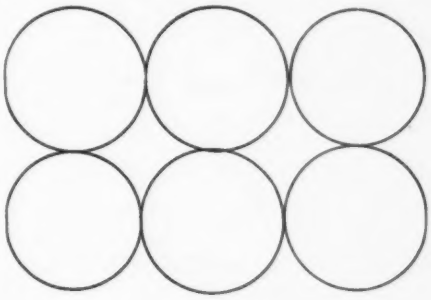


FIG. 2.

when heated by the cast metal, the coalescence of these in melting will have a tendency to close up the pores to some extent at least. For this reason partly a high percentage of fluxing impurities is found undesirable.

The proper permeability of a molding sand is a matter of vital importance, since it permits the gases to escape while the metal is being cast. These gases may be given off by the metal, or may be steam produced by the heat action on the moisture in the sand. A pathway must therefore be open for their escape, and if none is at hand blow holes are formed.

Since the degree of porosity of the sand is therefore an important matter, it becomes desirable to have some accurate means of measuring this if possible, and while several investigators have turned their attention to this problem, the results obtained have not been wholly satisfactory.

King has shown that the permeability

as indicated by "the time necessary for 5,000 cu. cm. of air to pass through a given sample holds no very apparent relation to the pore space, which was found, except, indeed, that generally the larger the per cent. of pore space the slower the air was in passing through." In other words the finer the sand, the lower its permeability

From this one might assume a general but not very close relation between pore space and permeability.

Since the measurement of the permeability of sands is more or less difficult, it is more desirable to determine the porosity, especially since this gives us an approximate gauge of the permeability of the material.

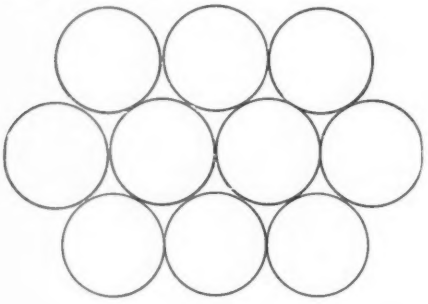


FIG. 3.

The pore space of a given volume of sand can be determined by the following formula:

$$\frac{Vd - W}{100\ Vd}$$

in which

V is volume of vessel in cubic centimeters,

d is specific gravity,

W is weight of the sand in grains.

The method employed for determining the porosity consists in filling a cylindrical vessel of known capacity with the medium whose pore space is to be determined and then computing the pore space from the weight of the material and its specific gravity.

The best results, according to King are obtained by allowing the sand to run into the receptacle in a fine steady stream. The closest packing and most uniform results being obtained by adding the material in small lots at a time, and gently tamping it with a broad flat faced pestle until the vessel was filled. After filling in this manner, the sides of the tube are gently jarred with light blows, until all reduction in volume ceases. In doing this it is necessary to hold the tube rigidly.

In the following table there is given the average fineness, specific gravity, and pore space in per cent. of the different Wisconsin and other sands tested, beginning with the brass sands and ending with the core sands.

		Average fineness	Specific gravity	Per cent pore space
53	Dye's special, Newport, Ky.	174	2.50	42.45
8	Zanesville, O.	163	2.72	44.70
9	Albany, N. Y.	143	2.62	44.41
16	Zanesville, O.	140		
43	No. 5, Newport, Ky.	140	2.60	40.11
52	No. 4, New Albany, Ind.	139	2.66	41.31
57	No. 1 molding sand, Hamilton Co.	130	2.59	42.66
55	No. 4, Waterford, Ind.	137	2.66	43.43
45	No. 3, Newport, Ky.	137	2.61	43.09
32	Racine, Wis.	136	2.65	44.14
27	Rockton, Ill.	134	2.56	42.09
44	No. 6, Newport, Ky.	132	2.64	43.26
54	No. 3, Waterford, Ind.	131	2.62	40.43
35	Pendleton property, Neenah	131	2.59	44.62
31	Rockton, Ill	129	2.67	43.58
17	Fairwater (Selected)	125		
34	Neenah, Brass sand	121	2.75	44.77
21	Altoona, near Eau Claire	119	2.67	46.83
51	St. Joe River, St. Joe Co., Mich.	110	2.59	46.45
19	No. 3, Berlin	106	2.57	42.38
36	Menomonie	106	2.63	44.95
7	Berlin	105		
49	No. 1, Indiana	105	2.59	45.18
28	No. 2, Berlin	103	2.60	39.4
24	Berlin	103	2.57	43.20
22	Garden City Sand Co.	93	2.59	40.60
47	Indiana No. 3	92	2.60	42.63
37	Marinette	92	2.50	39.18
26	Neenah	90	2.61	44.76
48	Indiana No. 2	88	2.62	38.00
29	Racine	86	2.60	37.66
23	LaCrosse	86	2.65	40.37
33	Racine	86	2.58	41.16
56	Wanatah sand, Valparaiso, Ind.	83	2.51	43.70
1	Berlin	83		
4	Pardeeville	82		
25	Janesville	78		
20	Wheatland near Burlington	76	2.51	47.26
6	Massillon, Ohio	74	2.58	42.76
15	Klondike, St. Charles Co., Mo.	73	2.59	34.98
3	Dover, Wis	72		
41	Janesville	70	2.73	32.91
11	Fairwater (selected)	68	2.61	32.00
12	Fairwater (run of bank)	66	2.63	33.90
50	Silverton, Kenosha Co., Wis.	63	2.55	39.52

		Average fineness	Specific gravity	Per cent pore space
42	Superior	63	2.61	32.50
65	Milwaukee, Wis.	63	2.61	32.50
35	Milwaukee, Wis.	62		
5	Pardeeville	62		
10	Pardeeville	62		
13	Core sand, Port Washington	62	2.62	36.23
46	South Milwaukee	54	2.61	38.83
58	Near Milwaukee, Wis.	53		
40	Kerrick, Minn.	49	2.65	33.91
2	Wheaton, Ill	41		
14	Ottawa, Ill	40	2.67	34.77
30	Janesville	40	2.58	40.41
39	Madison	39		

From this table we see that as the average fineness decreases, there is also in general a decrease in the porosity percentage.

Life of a Sand.—Most molding sands after being used once lose some of their desirable qualities, and after one or more heats become "dead" as the foundryman calls it. The length of a sand's life is therefore a matter of some importance. Some sands can be used but once, while others can be used over several times, with or without the admixture of some fresh sand. The deadness of the sand is no doubt due to its dehydration by the heat of the molten metal, its plasticity or bonding power being at the same time destroyed, and the amount of sand thus destroyed in casting will be a layer of variable thickness next to the metal. With small castings this will be but a fraction of an inch, and it will be correspondingly greater with large ones.

Refractoriness—A molding sand should be sufficiently refractory to prevent its fusing completely when in contact with the molten metal. For this reason highly siliceous sands are the most desirable, at the same time a very high percentage of silica is only to be gained at the expense of alumina or clayey matter and a consequent loss in cohesiveness or bonding power. The effect of the chemical composition on the refractoriness of the sand is discussed under the chemical analysis of molding sands.

There is no standard laboratory test for determining the refractoriness of a molding sand. Perhaps the best would be to make a mold of the sand to be tested and pour into this an iron of known composition so that its effect on the sand could be determined. Means not being at hand to carry out this test, the next best plan seems to be to mold the sand into cubes and heat these rapidly in a furnace.

Table III contains the results of a number of tests of this sort made by C. W. Hord and kindly placed at the writer's disposal. The cubes were made by mixing the sand up with sufficient water to make the grains cohere, and then forcing the sand into a wooden mold by blows from a 9¾ lb. lead rammer, with a drop of four inches. These cubes were then heated in a gas furnace to a temperature of Cone 6 (fusion point approximately 2282°F., or 1250°C.), the time required for burning being from 45 minutes to 1 hour. After burning the cubes were weighed, soaked in water for 48 hours and weighed again, the increase in weight indicating the amount of water absorbed and being therefore an approximate index of the porosity after burning. Of course it will be easily seen that any shrinkage of the mass, or fusion of the particles will serve to close up the pores and decrease the absorption. Since it was recognized that the amount of tamping the sand received, and the quantity of water used might affect the density, four mixtures were made up as follows:

1. Water taken 6.6 per cent., number of blows, 3.
2. Water taken 6.6 per cent., number of blows, 9.
3. Water taken 13.2 per cent., number of blows, 3.
4. Water taken 13.2 per cent., number of blows, 9.

The results obtained given in Table III are not without interest. If we examine the figures given in the columns headed cube tests, we find that in every case, more pounding or a greater amount of water for mixing, tended to decrease the porosity as evidenced by the absorption figures, but that the use of a higher percentage of water, seemed to reduce the porosity more than an increased number of blows, even though the former was only doubled while the latter was tripled.

One is somewhat puzzled to find the causes which govern the degree of porosity of the sand after burning. Taking the first absorption number of each set, we find that it ranges from 30 per cent. down to 2.8 per cent. This figure does not seem

TABLE III

LOCALITY	GRADE	MECHANICAL ANALYSIS											CUBE TESTS						REMARKS
		Trade Number	Laboratory No.	20 Mesh %	40 Mesh %	60 Mesh %	80 Mesh %	100 Mesh %	100 Mesh %	Clay %	Fineness	% of whole	Number of blows 9# lb hammer 4 in. fall	Number of cc. water per lb of sand	Air shrinkage %	% Absorption	Fire shrinkage %	% Pore space	
Riverside, Pa.	Light iron		1	2.42	6.60	1.00	18.64	.92	50.11	19.02	88.1	98.71							Much trouble from blow holes. All right for fine iron castings.
	Brass		5	.74	5.06		7.60	.32	63.02	21.66	107.8	98.40							This sand caused blow holes.
Albany, N. Y.	Heavy castings . .		6	4.8	22.54	.22	33.74	.76	26.84	9.78	62.5	98.68							Good for general foundry and heavy castings.
Zanesville, Ohio . . .	Car wheel	4	4	1.32	11.18	33.40	4.29	6.64	9.84	32.82	67.3	99.49	3 9 3 9	30 30 60 60	0 1	23. 17. 13. 8.	5. 0.	.35	Used for heavy malleables, cast iron pipe, heaviest ordinance, machinery castings, and air brakes.
Zanesville, Ohio . . .	Brass	1	3	.02	.45	2.02	.42	.86	80.36	15.06	125.9	99.19	3 9 3 9	30 30 45 45	0 0 0	30. 25. 25. 22.	1. 2. 1.	43	Fine, yellow, fine ornamental work, light iron, stove plate and brass castings.
Zanesville, Ohio . . .	Heavy and cupola	3	2	.19	.60	8.08	4.75	12.70	53.73	19.12		99.17	3 9 3 9	30 30 105 105	0 0	24. 20. 16. 11.	2. 2.5	37	Cubes burned red. Red sand used largely as No. 4. Also for lining ladles and cupolas.
Near Cincinnati, Ohio.	Very fine brass . .	0	7	.08	.12	.18	.10	.28	77.88	20.28		98.92	3 9 3 9	36 36 60 60	0 0	18. 12. 9. 7.	7.5 3.	45	Brass and light gray iron, mixed for stove plate.
Albany, N. Y.	Fine	1	8	.10	.14	.98	.12	1.18	64.94	30.76		98.22	3 9 3 9	30 30 60 60	0 0	2.8 1.7 .08 .02	10. 10. 7.5 10.	42	
Albany, N. Y.	Medium	2	9	.94	3.28	19.38	4.42	9.04	49.84	12.18		99.08	3 9 3 9	30 30 60 60	0 0 0 0	16. 15. 13. 8.	0. 0. 0. 0.	39	
Albany, N. Y.	Coarse	3	10	8.66	10.24	32.58	4.12	8.38	23.10	11.70	51.8	98.78	3 9 3 9	30 30 60 60	0 0 0 0	18. 12. 11. 5.	0. 5. 0. 0.	34	

Metuchen, N. J. . . .	Fine	11	3.44	12.40	25.84	6.60	19.12	24.50	7.28	59.	99.08	3	30	0	27.	0.	39	Much fine quartz and angular grains which clog meshes.
												9	30	dropped & crumbled				
												3	60	0	24.	0.		
												9	60	0	22.	0.		
Metuchen, N. J. . . .	Coarse	12	24.2	22.50	14.36	2.78	4.24	11.19	19.20	66.1	98.47	3	30	0	19.	0.	33	Same as above.
												9	30	0	16.	0.		
												3	60	0	8.4	0.		
												9	60	0	8.	0.		
Metuchen, N. J. . . .	Medium	13	3.96	7.50	13.48	6.34	15.30	31.68	21.	79.5	99.26	3	30	0	31.	0.	39	Same as above.
												9	30	0	16.	0.		
												3	60	0	16.	0.		
												9	60	0	9.	0.		
Florida Grove, N. J. .	Molasses sand . .	14	8.52	40.50	16.34	1.50	2.62	7.44	20.74		97.66	3	30	crumbled		0.	40	
												9	30	0	22.	0.		
												3	60	0	16.	0.		
												9	60	0	13.	0.		
Florida Grove, N. J. .	Core sand	15	32.92	37.66	23.84	.44	.54	.80	3.76		99.96	Impossible to make into cubes					38	Very fine quartz and some mica.

to stand in any direct relation to the average fineness or porosity of the green sand, neither does it appear to be directly related to the clay percentage.

It would seem that the porosity after burning is due to three causes, viz., amount of clay particles, an evenly proportioned number of the different sized grains, and the amount of fluxing impurities in the fine particles. That is to say, with a number of different sized particles there will be less porosity in the mass, than if most of the particles were of one size, because this enables them to flux together more readily because of closer packing.

Bonding Power or Tensile Strength.—Sands used for molding should possess sufficient strength or bonding power to make the grains cohere, after the flask in which they are tamped is removed, and also for the purpose of resisting the pressure of the molten metal in the mold, or its corrosive action while being poured into the mold. Pure sand has little or no tensile strength, clay alone has a comparatively high strength, and the amount of bond will depend partly on the fineness of the sand, and partly on the amount of clayey matter in it. The tensile strength of the molding sand will be likewise somewhat affected by the amount of moisture in it, moist sand cohering more strongly than dry sand. The moisture content should not be in excess however, otherwise the sand will pack too dense. With clay the amount of coherence will not be seriously influenced by the amount of moisture, since the particles in drying shrink together, but with sand or even loamy sand when the shrinkage is exceedingly slight or even zero, there is no drawing together of the grains in drying, and therefore the presence of moisture aids the bonding power. Pressure may likewise increase it.

Where the mold is of complex design it is obvious that a stronger bond is necessary than for simple patterns. In such cases it may become necessary to increase the bond by the addition of some binding material, for a high bonding power in sand is to be obtained naturally only by the use of a very clayey material.

The Chemical Analysis of Molding Sands.—A difference of opinion appears

to exist regarding the value of a chemical analysis of molding sands, and but few such analyses are on record. Those which have been published usually show a percentage of silica and consequently it has sometimes been assumed that all molding sands are highly siliceous. That this is not so in all cases is shown by the few analyses which were made for the Wisconsin work.

While the physical properties of molding sands are of pre-eminent importance, the chemical properties of the sand should not be neglected, especially since the chemical analysis may show the presence of objectionable elements, such as fluxing impurities, which are at times present in surprisingly large quantities.

Much the same interpretations can be made from a molding sand analysis as from that of a clay.

A high silica percentage indicates a large amount of quartz, while from the alumina and chemically combined water, we can make some estimate of the amount of clay present. The analysis will furthermore indicate the amount of fluxing impurities, such as iron, lime, magnesia and alkalies which the sand contains.

In most published analyses the percentage of the last four is very low, but in some of the Wisconsin sands the lime and even magnesia occur in appreciable quantities.

The allowable limits of the different ingredients, is not as a rule given.

Bolland* states regarding the chemical composition of molding sand that "3% of metallic oxides in sand seriously diminishes its refractory qualities and 1% of lime measurably lessens its value as a good molding sand, as the carbonate is acted upon by the intense heat and gives off CO_2 which disturbs the face of the mold during its escape causing honeycombed and rough surfaces on the casting. Caustic lime will cause a slag on the surface of the casting.

"Sands which contain the largest percentage of silica, from 1 to 3 per cent magnesia, with as much alumina as will impart cohesiveness and plasticity are under almost all circumstances the best for facing sand. Lime should not be present in even the smallest proportions."

*Encyclopædia of Foundry.

In specifications for molding sand, prepared by Mr. Scott of the Case Threshing Machine Co., Racine, Wis., the following statements are made regarding the chemical composition of sands for molds and cores.

Molding Sand.—"Molding sand for iron work generally contains from 75.00 to 85.00 per cent of silica, 5.00 to 13.00 per cent. of alumina, usually less than 2.50 per cent. of lime and magnesia, not over .75 per cent. of fixed alkali (soda and potash), generally less than 5.00 per cent. of iron oxide, and seldom more than 4.00 per cent. of combined water."

"Sand for brass molding may contain a much higher percentage of iron and lime without doing any particular harm."

"All molding sands usually contain some organic matter, generally present in the form of small roots or as decomposed vegetable matter."*

"Carbonate of lime must not exceed 1.50 per cent. in an iron molding sand, and should not exceed 2.25 per cent. in a brass sand.

"Iron oxide must not exceed 5.50 per cent. in the iron molding sand, or 7.00 per cent. in a brass sand."

"Organic matter must not exceed 1.00 per cent. Clay and silt are objectionable, consequently any sand showing an analysis more than 13.00 per cent. alumina is rejected."

Mr. Scott gives the following analyses of molding sands used for different grades of work.

	Light Iron Work	Medium Iron Work	Heavy Iron Work	Ligh Bras
Silica	82.21	85.85	88.40	78.86
Alumina	9.48	8.27	6.30	7.89
Iron oxide	4.25	2.32	2.00	5.45
Lime	....	.50	.78	.50
Lime carbonate ..	.68	.29	...	1.46
Magnesia	.32	.81	.50	1.18
Soda	.09	.10	...	.13
Potash	.05	.03	...	.09
Manganese	...	tr	.25	tr
Combined water .	2.64	1.68	1.73	3.80
Organic matter ..	.28	.15	.04	.64
Specific gravity ..	2.652	2.654	2.63	2.64
Degree fineness .	85.18	66.01	46.86	94.88

Mr. Scott states further, that "so far as chemical composition is concerned, any one of the above sands would answer fairly well for nearly any class of work, but it is absolutely necessary that the proper degree of fineness be considered.

*The amount present is generally so small that it can be neglected.

Core Sand.—"As a rule a core sand should be high in silica and low in alumina." A sand low in alumina will permit of the rapid escape of the gases whereas a high alumina or clay sand bakes and holds back the gases.

The two following analyses, although radically different, are good core sands, due entirely to low alumina and iron.

	Extra Quality Core Sand	Fair Quality Core Sand
Silica	94.30	69.31
Alumina	1.95	4.76
Iron oxide	.33	1.58
Lime carbonate	1.63	3.50
Lime sulphate	....	8.19
Magnesia	.54	7.77
Alkalies	.05	.12
Combined water	1.05	2.95
Organic matter	.15	1.82

"The effects of each of the elements commonly found in sands are as follows:

Silica is a refractory element, does not shrink when heated, and has little or no binding power, therefore in a highly siliceous sand the bond must be supplied either by the addition of clay, or some artificial compounds.

"Alumina is present in variable amounts in clayey or loamy sands, and aids indirectly therefore in bonding the sand. It is a refractory element of the sand, but has a high shrinkage, and therefore too much alumina makes the mold bake dense.

"Lime is a fluxing element, and if present as carbonate, loses its carbonic acid and makes the mold more porous. The conversion of lime salts into oxide, causes the mold to drop or crumble if they are in excess.

"Iron, might be present in the form of ferrous oxide, ferric oxide, hydroxide, or ferrous carbonate, which may be converted into ferric oxide by heat, although it is probable that those portions nearest the mold are changed into ferrous oxide. It acts as a flux.

"Magnesia is probably like lime in its fluxing behavior towards fluxes.

"Organic matter may exert some bonding action on the sand, but in most sands there is but little present. It would burn out readily, and add to the porosity of the mold.

"Combined water will be present in any sand containing clay, limonite, or gypsum. It is driven off at a low red heat and thus increases the porosity of the sand.

The following analyses of molding sands have been collected from various sources.

These analyses, it will be observed all show a high percentage of silica, since most of the sands used are of siliceous character. They do not however show the variations in composition existing in molding sands.

These are well brought out by a few analyses made for this paper.

1. Core sand, Miltmore Quarry, Janesville, Wis.
2. Upper bed, Rockton, Ill.
3. No. 2 sand, White and Traugott Pit, Berlin, Wis.
4. Lower bed, Rockton, Ill.
5. Brass sand, Pendleton Pit, Neenah, Wis.
6. Sand from pit of Menomonie Hydraulic Pressed Brick Co., Menomonie, Wis.
7. Lake sand, Superior, Wis.
8. Fine sand, Albany, N. Y.

Two of these analyses, Nos. 4 and 5, show a very low silica content, and therefore show a correspondingly higher percentage of fluxing impurities, especially lime. Nos. 2 and 4, are of interest as showing the great difference in composition which may exist in different beds of the same bank. The others are mostly of siliceous character.

If the main use of a chemical analysis of a sand is to indicate the amount of fluxes and silica which the material contains, there is some doubt in the writer's mind, whether an analysis of the sand in bulk is what is needed. Such an expression of the composition does not show us in what condition the fluxes exist, that is to say, whether they occur in the coarsest or finest particles. If in the former their fluxing effect will be less active than if in the latter.

In most sands the fluxes are probably contained largely in the finer particles, especially if the deposits are of sedimentary character, for in these the coarse grains would represent the more destructible mineral grains, such as quartz.

If however the material is a residual sand that is by rock decay in situ, and some molding sands are, then the fluxes might exist wholly or in part in larger

grains of partially decomposed silicate minerals.

In order to illustrate the uneven distribution of fluxing materials, a partial analysis was made of the several sizes of grains in a No. 2 sand from Berlin, Wis., with the following results.

Size.	60	80	100	100	Clay
Silica	95.92	94.35	94.66	91.06	61.54
Alumina	1.29	1.47	1.47	4.57	23.16
Ferric oxide	.56	.56	.40	.80	1.60
Lime	.10	.04	.34	.72	1.37
MgO & Alk. By diff.....	2.13	3.58	3.13	2.85	4.33
Loss, ignition	undetermined				7.90
Total	97.87	96.42	96.87	97.15	95.57

Here we see that the finer particles are much less siliceous, more highly aluminous and carry a higher percentage of fluxes than the other sizes.

uncommon. In addition to quartz, feldspar, mica, and even garnet were sometimes noted. Several sands contained little sand tubes in the 20, 40, and even 60 mesh sizes. These were apparently cemented by calcium carbonate.

In a few, the grains retained on the 20 mesh were not simple minerals but small quartzite, gneiss, schist, and limestone. All of these were invariably angular. None of the sizes under 20 mesh could be said to be markedly angular although a few were subangular.

After examining this large number of samples under the microscope, one is forced to the conclusion that very little is to be gained from such an examination.

Mode of Occurrence of Molding Sands—Molding sands may be either

	I	II	III	IV	V	VI	VII	VII
Silica	92.083	91.907	92.913	90.625	81.50	84.86	82.90	79.81
Alumina	5.415	5.683	5.850	6.667	9.88	7.03	8.21	10.00
Ferric oxide .	2.498	2.177	1.249	2.708	3.14	2.18	2.90	4.44
Lime	tr	.415	tr	tr	1.04	.62	.62	.70
Magnesia	.....	.....	.....	.....	.65	.98	0.00	.88
Potash	.....	.....	.....	.....	....	....	....	....
Soda	.....	.....	.....	.....	....	....	....	....
Water	.....	.....	.....	.....	3.00	3.20	2.85	2.89
Org. matter ..	.....	.....	.....	.....	tr	tr	tr	tr

I. Sand from foundry of Freund at Charlottenburg.
II. Bronze sand, used at Paris.
III. Sand from Manchester.
IV. Sand from Lagua foundry at Stromberg.
Kampmann, Ann. des Mines, Sed. 4, Vol. VIII, p. 689. 1895.
V. Fine sand.
VI. Sand for medium weight castings.
VII. Coarse sand for heavy castings.
VIII. Sand for heavy machinery in dry sand molds.
W. Ferguson, Iron Age, Vol. LX, p. 16. 1897.

	I (25)	II (27)	II (28)	IV (31)	V (34)	VI (36)	VII (42)	VIII (9)
Silica	88.52	79.41	90.68	57.63	44.24	88.35	87.47	79.61
Alumina	5.63	12.47	5.95	10.03	11.89	11.57	6.59	11.21
Ferric oxide	.88	.80	.48	.88	1.44	1.04	.80	2.48
Lime	1.20	.99	.69	11.16	13.71	1.33	1.18	.74
Magnesia	.83	.81	.44	5.63	5.90	.66	1.10	1.07
Ignition	2.65	3.96	1.05	14.66	18.49	2.45	.60	2.65
Alkalies	Not determined.							
Total	99.71	98.44	99.29	99.99	95.67	97.40	97.74	97.76

Mineralogical Composition—The mineralogical composition of the Wisconsin molding sands as well as that from a number of other localities is remarkably monotonous. A microscopic examination was made of all the different sizes obtained in the sieve tests, and in nearly all with the exception of the clay the predominating mineral was quartz. This sometimes formed 90 per cent. of all the grains in the sample. The grains are mostly rounded, and while those on the 20 and 40 mesh were often quite free from iron the smaller sizes often exhibited an abundant stain of limonite. Compound grains of quartz sand cemented by limonite were by no means

of residential or sedimntary character. fragments of rock, such as sandstone, To the first class belong those sands formed by the disintegration of the rock in situ, while the second includes those formed by the decomposition of sandy or loamy material in water.

Residual sands may be derived from either crystalline or sedimentary rocks. If from the former their particles are likely to be angular; if from the latter the grains would tend to show a rounded form. No deposits of the first type of residuals are known in Wisconsin, although they might possibly exist, but examples of the second type are not un-

common. The Potsdam sandstone of Wisconsin is in many localities so soft that it weathers easily to a mass of highly siliceous sand, which is composed almost entirely of rounded quartz grains. At many localities where the stone is exposed it is so soft that very little power would be required to disintegrate it completely if it is not already in that condition.

Sedimentary sands and loams are much more abundant, and form the main type of material obtained in the state. These sands represent sediments laid down by water in lakes, along the flood plains of rivers, or have been deposited by streams flowing from the margin of the ice sheet during the glacial period. Some of those found in the belt bordering the Great Lakes have been formed in the waters of these during a period when they covered a greater territory than they do now.

The coarseness of the material laid down will increase with the velocity of the current which deposited it, and variations in the velocity over any one area, will result in the accumulation of layers of different texture. Sand deposits not infrequently show both horizontal and vertical variation, and in the examination of a sand bank, care should be taken to ascertain whether there is a sufficient quantity of the desired grade present. Some deposits though otherwise good, are spoiled by the presence of clay lumps scattered through them.

In many areas, especially along the lakes, dune sands cover tracts of considerable extent. The materials forming these dunes are usually of little value, because they commonly lack even the small amount of clayey material necessary to bond the sand when moist.

In many districts three or four different grades of sands are obtained from separate pits all lying within a few rods of each other. Or again one bed may persist over a large area, with a thickness of not more than two feet, and underlaid by an equally persistent bed of totally different grade or texture.

Owing to the complexity of the glacial deposits in which most of the Wisconsin molding sands occur, it is difficult to lay down any rules that will guide the layman in his search for them. If, however, laboratory methods prove to be of practical value it becomes a comparatively easy matter to collect samples from all available localities and put them through a rapid preliminary examination.

METALLURGICAL SECTION OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

H. E. DILLER, SECRETARY.

REPORT OF THE COMMITTEE ON STANDARD METHODS FOR THE ANALYSIS OF IRON.

In our last annual report a standard method for the determination of silicon in iron was outlined, and at the session of the Metallurgical Section this method was adopted as the official standard. Printed copies of the method were sent to several hundred foundry and blast furnace metallurgists and chemists and brought forth such favorable comments that your committee was encouraged to go further with the work this year, and now submits for your criticism methods for the determination of Total Carbon and Sulphur.

Total Carbon.

This determination requires considerable apparatus; so in view of putting as many obstacles out of the way of its general adoption in cases of dispute your committee has left optional several points which were felt to bring no chance of error into the method.

The train shall consist of a pre-heating furnace, containing copper oxide (Option No. 1) followed by caustic potash (1.20 S. Gr.), then calcium chloride, following which shall be the combustion furnace in which either a porcelain or platinum tube may be used (Option No. 2). The tube shall contain four or five inches of copper oxide between plugs of platinum gauze, the plug to the rear of the tube to be at about the point where the tube extends from the furnace. A roll of silver foil about two inches long shall be placed in the tube after the last plug of platinum gauze. The train after the combustion tube shall be anhydrous cupric sulphate, anhydrous cuprous chloride,

calcium chloride, and the absorption bulb of potassium hydrate (Sp. Gr. 1.27) with prolong filled with calcium chloride (Option No. 3.). A calcium chloride tube attached to the aspirator bottle shall be connected to the prolong.

In this method a single potash bulb shall be used. A second bulb as sometimes used for a counterpoise being more liable to introduce error than correct any error in weight of the bulb in use, due to change of temperature or moisture in the atmosphere.

The operation shall be as follows: To one gram of well mixed drillings add 100 c. c. of potassium copper chloride solution and 7.5 c. c. of hydrochloric acid (conc). As soon as dissolved as shown by the disappearance of all copper, filter on previously washed and ignited asbestos. Wash thoroughly the beaker in which the solution was made with 20 c. c. of dilute hydrochloric acid (1-1), pour this on the filter and wash the carbon out of the beaker by means of a wash bottle containing dilute hydrochloric acid (1-1) and then wash with warm water until all the acid is washed out of the filter. Dry the carbon at a temperature between 95 and 100 degrees C.

Before using the apparatus a blank shall be run and if the bulb does not gain in weight more than 0.5 milligram, put the dried filler into the ignition tube and heat the pre-heating furnace and the part of the combustion furnace containing the copper oxide. After this is heated start the aspiration of oxygen or air at the rate of three bubbles per second, to show in the potash bulb. Continue slowly heating the combustion tube by turning on two burners at a time, and continue the combustion for thirty minutes if air is used; twenty minutes if oxygen is used. (The Shimer crucible is to be heated with a blast lamp for the same length of time.)

When the ignition is finished turn off the gas supply gradually so as to allow the combustion tube to cool off slowly and then shut off the oxygen supply and aspirate with air for ten minutes. Detach the potash bulb and prolong, close the ends with rubber caps and allow it to stand for five minutes, then weigh. The increase in weight multiplied by 0.27273 equals the percentage of carbon.

The potassium copper chloride shall be made by dissolving one pound of the salt in one liter of water and filtering through an asbestos filter.

Option No. 1. While a pre-heater is greatly to be desired, as only a small percentage of laboratories at present use them, it was decided not to make the use of one essential to this method; subtraction of the weight of the blank to a great extent eliminating any error which might arise from not using a pre-heater.

Option No. 2. The Shimer and similar crucibles are largely used as combustion furnaces and for this reason it was decided to make optional the use of either the tube furnace or one of the standard crucibles. In case the crucible is used it shall be followed by a copper tube 3-16 inch inside diameter and ten inches long, with its ends cooled by water jackets. In the center of the tube shall be placed a disk of platinum gauze, and for three or four inches on the side towards the crucible shall be silver foil and for the same distance on the other side shall be copper oxide. The ends shall be plugged with glass wool, and the tube heated with a fish tail burner before the aspiration of air is started.

Option No. 3. Barium hydrate is so extensively used as an absorbent for the carbon dioxide that your committee decided to make no recommendation as to whether its use should be made optional, but leave that point to be decided at the general meeting of the Metallurgical Section.

Determination of Sulphur.

Dissolve slowly a three gram sample of drillings in concentrated nitric acid in a platinum dish covered with an inverted watch glass. After the iron is completely dissolved add two grams of potassium nitrate, evaporate to dryness and ignite over an alcohol lamp at red heat. Add fifty c. c. of a one

per cent solution of sodium carbonate, boil for a few minutes, filter using a little paper pulp in the filter if desired, and wash with hot one per cent sodium carbonate solution. Acidify the filtrate with hydrochloric acid, evaporate to dryness, take up with fifty c. c. of water and two c. c. of concentrated hydrochloric acid, filter, wash and after diluting the filtrate to about 100 c. c. precipitate with barium chloride; filter, wash well with hot water, ignite and weigh as barium sulphate, which contains 13.733 per cent of sulphur.

REPORT OF COMMITTEE ON STANDARD METHODS OF MAKING BEDS.

Your committee in undertaking this work, was fully aware of the difficulties to be met with in having molders who are accumstomed to their own ways follow any rule, or set of rules, laid down for them. For that reason we gave the table prepared by Mr. West to an apprentice, who had been working at the trade about a year and instructed him to follow the directions to the letter.

It must be said that this apprentice turned out exceptionally good work as the result, for his plates when cast far surpassed those made by molders of mature years and experience. As the apprentice progressed with the work he became more and more interested, and a decided improvement manifested itself in casting after casting, as it was made. The metal was poured in various ways, and but two plates were scarred and then only ⅛ inch deep.

For plates with wide and deep prickers, we took the additional precaution of driving down cast iron rods between the rows of prickers and thoroughly venting them with a 3-16-inch vent wire. After building the runners and cleaning out the loose sand from the surface of the plate, we took a dust bag and shook on a fair coating of Portland cement, which has a tendency to form better surfaces than plumbago or lime. As the cement, after standing a few minutes, absorbs moisture from the sand and sets, it leaves a very tough and rigid surface, without being hard. This reduces the possibility of cutting in front of the runners, and holds the edges around the prickers in a very firm manner.

We present this report for your information and approval, and suggest that all foundrymen who are doing this class of work, and wish to save money, should adopt Mr. West's method. We feel certain that once it becomes better known, foundrymen will appreciate what Mr. West has done for them in this particular.

We would respectfully submit, that our work being accomplished, that the committee be discharged. We further advise that the foundrymen of this country take up the question for themselves and communicate their results to the secretary of the association, so that the next meeting may thoroughly ventilate it, and added information be thus obtained.

Respectfully submitted for the committee,

CHAS. H. THOMAS, chairman.

South Norwalk, Conn., May 18, 1906.

TRADE PUBLICATIONS.

The paper which has so long been well known to the public under the name of *Compressed Air* has changed hands. It has been owned by the Compressed Air Publishing Co., of which W. L. Saunders has been president. The paper is now owned by the Kobbe Co., New York City, and will be published by it in the future. The officers now in charge of the paper are W. L. Saunders, editor; W. R. Hulbert, managing editor, and P. F. Kobbe Jr., business manager. The size of the publication in the past has been kept at standard catalog size, that is, to regular magazine size, 7 by 10 inches. 6 by 9 inches. It has now been increased

"Sandcraft" is the name of a small booklet, 3½ x 6 inches, issued by C. Drucklieb, 132 Reade street, New York City. This work contains notes concerning the operation of the injector sand blast, and should be in the hands of all foundrymen interested in this method of cleaning castings.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Malleable Iron and Steel.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

We have also made arrangements with several others to act as special contributors. All inquiries should be add essed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

CUPOLA LINING BURNING OUT.

Question.—We wish advice regarding a Byram 76-inch cupola. It is 14 feet from the melting point to the charging door. It has a double row of tuyeres but on account of running a small heat at the present time we have stopped up the upper tuyeres and find that the lining will eat out very quickly between the lower tuyeres of which there are five and they flare out on the inner ends so as to leave very little brick between them. The blast pressure is constant as we use a positive blower driven by a link steel belt. The wind shoots straight across the furnace and not upwards. We use the solid brick block which burns out in two weeks.

Answer.—The cupola is all right. For small heats you do well to stop off the upper row of tuyeres because in any heat, large or small, when the last iron settles down the wind blows over the top of the charge and cools the cupola. I prefer to stop the upper row even for large heats. With both rows open, even with a 50-inch cupola you cannot melt one ton only of iron and what is true of one ton is true of the last ton with a large heat. I should think your blast was too strong. You should have a gauge and cut the pressure down to 16 ounces. I prefer the ordinary cheap stock brick for a lining. They last as long and are cheaper and easier to replace than the large blocks.

Charge very carefully and uniform so as to leave no openings in the stock for wind to blow through and the blast could not in such case reach the opposite side.

Water-Jacketed Automobile Cylinders.

Question.—We are trying to get sound castings by melting in a crucible No. 1 charcoal pig iron containing graphite, 1.95; C. C., 1.14; Mn. 0.58; Phos., 0.104; Sul., 0.17; silicon, 2.23 per cent, but we get blow holes and spongy spots.

From information gathered from your book "Cast Iron" I would be led to believe that Si, 3.25; Mn, 1.00; Phos., 1.00; with low sulphur would give me sound castings.

Would ¼ of one per cent of aluminum and two or three per cent of nickel improve the mixture? Do you think that I would get better results from crucible than from cupola?

I also want to cast piston rings ¼ inch wide, ⅛ inch thick and four inches diameter. We want these rings when cut to stand a spread of one inch without set.

Answer.—I think you are using an iron totally unfit for the purpose. As you run a stove foundry I would try your ordinary cupola iron. You did not get the correct idea from my book. 3.25 per cent silicon is much too high for this work. You may be obliged to run a small cupola for the right kind of castings. The silicon should be as low as possible for both cylinders and rings and still have them machine well.

The phosphorus should be below one per cent but not far below.

Manganese anywhere from one per cent and lower. Scrap will close the grain. It would be well to try a very small piece of pure aluminum in the ladle before it is filled with iron. This will prevent blow holes and make the iron more fluid. Don't use nickel.

High Phosphorus in Stove Plates.

Question.—Formerly one per cent was considered very bad but I find my irons running as high as 1¼ per cent and yet I have a strength of 400 pounds on the half-inch test bar and a shrinkage of .140.

Such iron should prove good stove plate.

Answer.—I would not allow phosphorus to run over 1.00 per cent for stove plate and not much lower, you need this much to get the iron to fill the molds.

Phosphorus does not make a machine casting hard but in stove plate it produces a hard surface on some castings which is very difficult to polish.

More than one per cent will increase your breakage in the shop and during shipment.

The 400-pound strength sounds right but stove plate will not stand much hammering if phosphorus is 1¼ per cent.

To Cast a Thread with a Chill.

Question.—Our competitors are making a casting in which a cast iron screw is laid in the mold and afterwards screwed out leaving a thread. What solution should we use to get a clean thread?

Answer.—I should favor a sand core, but you can use shellac or oil to cause a coat of parting sand or of plumbago to adhere to a threaded chill which can be screwed out. The danger is from discount castings on account of blowing. Chills work well for a time but will begin to blow unexpectedly.

MALLEABLE CAST IRON NOTES

Dr. Richard Moldenke

M. A. asks for the best method of analyzing a "malleable" mixture. He gets the furnace analyses, but wishes to be more certain of what he is doing.

In making malleable castings one should of course know exactly what goes into the mixture, in order that the castings made will have the composition best adapted for their use. The old way was to make the metal sufficiently soft (high in silicon) to answer for the light sections. The result was that heavy pieces invariably were "low" and oftentimes weaker than common gray iron.

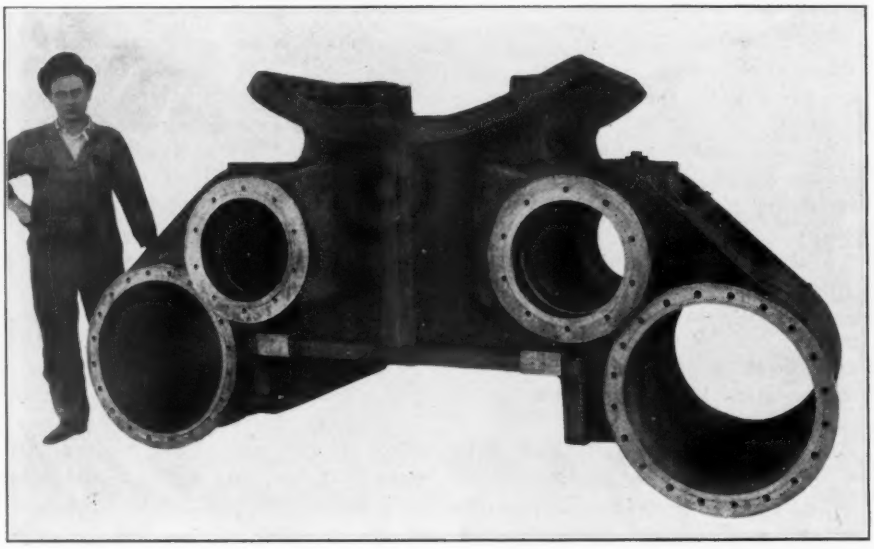
As the specifications for pig iron to be used in the malleable foundry should call for silicon ranging from 0.75 to 1.50, the actual amount being given at the time of purchase; sulphur not over 0.04; manganese not over 0.60; phosphorus not over 0.200; the checking of the furnace analyses becomes comparatively easy. An occasional determination for the manganese, and phosphorus is sufficient, as furnaces running on standard ores seldom vary much in these ingredients. The sulphur must be checked up oftener, especially where the cars are running close to the limit. The silicon should be determined for each car. In my own practice I have always called for silicon 0.75, 1.00, 1.25, and 1.50. Now as the cars came in, and naturally varied from the above standards called for, they were placed on the pile nearest their analysis. Thus, a car running 0.90 was put on the 1.00 pile. A car with 1.35 went on the 1.25 pile. Each car load was spread out over a long pile, and this pile run up as high as could be handled cheaply and comfortably. The iron was then drawn from the end, thus giving a perfectly uniform analysis for mixture purposes. At one time I had as much as 5,000 tons of iron piled up when stocking up for an active season, and only one analysis to use for making the mixture. The results were perfect owing to the method of spreading the iron.

The next thing in the mixture is the scrap. The domestic scrap, or sprues should be analyzed daily for silicon, to know whether the iron is of proper composition before it goes into the anneal. It is safer to figure it a little lower in silicon when making up the mixture than it actually is, for the small particles of iron in melting lose more silicon than big castings. The malleable scrap used should be figured at about 0.45 silicon whatever it may be, for by the time it is melted that will be all it contains. Steel scrap, if used, should be counted as having no silicon for mixture purposes. In this way, knowing that the stock charged does not contain more than the limit allowed for sulphur, phosphorus and manganese, the silicon only need be reckoned with, and by following the above method, giving a sufficient percentage of silicon in addition to make up for the burning out (usually 0.35 for the air furnace and open-

hearth, and 0.25 for the cupola) the most perfect results day in and day out will be obtained, provided the furnace and melting is all right.

M. A. asks further about the annealing temperature. This should always be measured in the coldest part of the oven, say near the bottom of one of the boxes in the front row. The element (if the Le Chatelier pyrometer is used, or the copper cylinder, if the Siemens water pyrometer) should be protected from the current of gases in the oven by a suitable enveloping medium, and placed against the pot. If this is not done the temperature registered will be several hundred degrees above the actual temperature of the pot. This may account for the temperature of 1050 Centigrade (or of about 1900 degrees F.) obtained by M. A., a temperature at which white iron begins to melt. Possibly his pyrometer was off, as even cupola iron would be burnt at this high heat in the anneal.

In further answer to M. A. would say that the American Society for Testing Materials has issued specifications for foundry iron (for gray casting purposes) as well as specifications for malleable castings. Write to Professor Edgar Marburg, University of Pennsylvania, Philadelphia, for these. The only book so far published on malleable castings is one written by myself for the International Correspondence Schools, of Scranton, Pa., from whom you can get this. I understand another book on the subject will be out some time in the coming fall. THE FOUNDRY will doubtless be able to supply you with this.



AN INTERESTING STEEL CASTING.

AN INTERESTING STEEL CASTING.

Every year sees steel castings cutting into the gray iron casting field in new and unexpected ways. There are two factors which are influencing the increased use of steel castings; first, the modern machinery has to be stronger than that used previously, and second, it must be as light as possible. This means that we must use stronger material. These conditions have been brought about by the higher steam pressures used in steam machinery, by the high pressures used in hydraulic machinery, and by the great strains brought upon other macihnes by their rapid movement or by the excessively heavy duty required of them.

On the other hand the steel casting manufacturers have been constantly im-

proving their methods their molding materials, facing materials, etc., and this has enabled them to meet the demand for these special castings. The sand blast for cleaning csatings and many similar factors hâve played an important part in these changes.

The accompanying illustration shows a pair of large cylinders made for the Pennsylvania railroad by the Penn Steel Casting & Machine Company, of Chester, Pa. Six or eight pairs of these cylinders have been made, tested, and put into use. The cylinders are fitted with a cast iron barrel or bushing in order to increase their wearing qualities, the steel being depended upon to give the desired strength to resist the strains due to the high steam pressures now carried. It has been found practicable to cast thinner sections than those of cast iron, and from material equal to that of forgings in every respect. Specimens from these cylinders were tested and showed the following physical characteristics, viz:—Tensile strength, 72,400 pounds; clastic limit, 34,000 pounds; elongation in 2 inches, 30 per cent; reduction in area, 41 per cent.

A NEW BOOK.

Eminent Engineers by Dwight Goddard, New York, The Derry-Collard Co. 5¾ inches x 8 inches.—280 pages. Cloth. Supplied by THE FOUNDRY for $1.50.

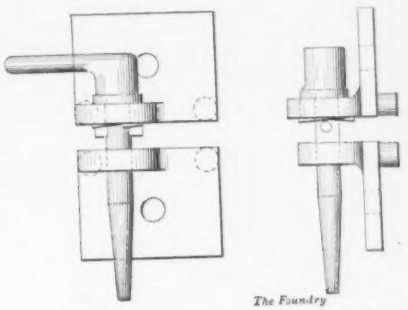
Every engineer is frequently asked something of the life history of some of the men that have made engineering famous, and few have at their tongue's end the history of these different men. On this account every engineer should have at hand some work from which he can obtain information concerning the life and work of those who have done so much for engineering. Mr. Goddard has made a special study of this subject for a great many years, and gathered together a rare collection of biographies and portraits, which he has finally collected into the little book under consideration.

The volume contains the biographies of sixteen European and sixteen American engineers. These are not the ordinary dry history of a man's life, but are written in an interesting style, so that it is a pleasure to read the book.

A FLASK PIN.

W. D. Browning writes us, stating that some time ago, he noticed in THE FOUNDRY a description of an improved flask pin which was claimed to be patented, and ever since, has been trying to find time to send in the description of a pin which he got up several years ago, and which is in use at the plant of the Southern Engine and Boiler Company of Jacksonville, Tenn.

It is evident from this that two men



Front *Side*

have worked out the same idea in different parts of the country, as the pins differ only slightly in detail. As Mr. Browning states, it is another evidence of the old saying, "Necessity is the mother of invention.

The accompanying illustration shows the general arrangement of the pin with the two cam faces, which serve to lock or draw the parts together.

INQUIRY.

One of our subscribers sends in the following inquiry which he would be glad to have some of the readers of THE FOUNDRY answer: "We have a line of work which requires steel to be burned fast to cast iron to be used for vise jaws and would like to ask how this can be done to insure a good solid job."

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TRADE OUTLOOK.

Usually there is a season of dullness in midsummer, but as July approaches no indication of such a season is manifest. The foundries and other iron and steel industries are all very busy. One feature which is of interest is that the attempt made recently by a number of southern producers to maintain the price of No. 2 foundry iron at $14 Birmingham has been abandoned and sales are being made in an open market. Iron has been sold as low as $13 Birmingham, but the leading producers are asking $13.50. In the north and in districts where southern iron is not in use extensively, prices are firm and in some cases advancing. No. 2 foundry is quoted at $16.50 valley furnaces. The coke situation is easier, as practically all of the ovens are in operation. The railroads are experiencing comparatively little difficulty in handling their freight and shipments are going forward in a very satisfactory manner. In the heavy casting line the margin between the cost of materials and labor on one hand and the finished product on the other is still very close and careful work is required to make the books show a profit at the end of each month. In the light gray iron casting field, where the cost of material does not play as important a part, conditions are reported to be somewhat better.

FOUNDRYMEN'S ASSOCIATION MATTERS.

Never before in the history of the foundry industry have there been so many indications of harmony and general advancement on the part of foundrymen in all parts of the world. The meeting of the American Foundrymen's Association which has just closed in Cleveland was the largest, best attended and most enthusiastic convention of this body which has ever been held. The foundrymen and foundry foremen have worked together and have accomplished great things.

In England the British Foundrymen's Association is in a prosperous condition and is organizing new locals and growing rapidly in interest and enthusiasm as

well as in membership. In the current issue on another page we record the formation of the North German Foundry Foremen's Association. All of these tendencies show that the foundrymen are finding that their greatest advancement lies in the "help one another" policy, in other words, in the exchange of ideas.

The exhibit of foundry supplies and equipment in connection with the American Foundrymen's Association and the forming of the American Foundry Supply Men's Association to work with the older organization, marks an important point in the career of the American Foundrymen's Association. This exhibit itself was extremely instructive and showed in a very marked manner many tendencies in modern foundry practice, and it is worth while to stop and consider some of these.

First and foremost, the convention made it evident that the foundry of the future is to use machinery and use it extensively. The machine shop has been adding labor saving devices every year, and still today there are far more men working in the machine shop than there ever were before. The same thing will be true of the foundry and the rapid increase in the use of mechanical appliances will result in cheaper castings, which in turn will result in the use of more castings, as has always been the case.

One of our foreign friends in visiting the convention made a remark which was highly interesting, especially as he did not seem to comprehend the real underlying principle which governed the conditions he noted. He said that he did not see how American foundrymen had much advantage over Germans and that their foundry practice was in advance of ours in many points, and also said: "You pay your help three times as much as we do, and still you manage to undersell us in the price of castings." There are two reasons for the above statement. The first and principal reason is that we use mechanical appliances to a far greater extent than any other nation. The second is that a large proportion of our workmen are Americans, no matter where they were born, and they have caught the American spirit which stands for advancement. We do not have fixed traditions as to how things must be done in this country, and if competition must be met we devise some rig and find some quicker and cheaper way to accomplish the same results.

To return to the exhibit, it is certain that every one attending was struck with the large variety of molding machines shown and with the important place which they are to fill in the future foundry. No one molding machine can fill all conditions and the molding machine men are beginning to recognize this. One of the large makers of power ramming machines was standing near the Berkshire exhibit when an interested party was looking over the exhibit. The prospective purchaser joked the power ramming machine man about the automatic machine. The reply which he received was probably unexpected, for the statement was, "The Berkshire machine, for its class of work, stands without a peer. Its field is limited, but within its field it excels all other machines." Similarly, the various molding machine exhibitors showed that each recognized that the other had a legitimate field in which to work, and even in the case of competing firms in the same field there was evidence of a friendly feeling between the makers. The idea of one concern fighting another is poor policy, and as the firms go forward to solve the problem of how we shall make our castings better and cheaper they are sure to reap a corresponding reward. The molding machine exhibits are described in detail elsewhere and hence it is not necessary to do so here, but we may say that the hall contained all of the principal types required for equipping a modern foundry.

There is one point in connection with the sand and sand machine exhibits which is of especial interest. The Interstate Sand Co. had on exhibit sands which were made by blending natural sands from the pit so as to obtain the required composition and to produce a uniform mixture. Several of the other companies also had on exhibit ground silica sand. These tendencies to improve on the natural product mark one of the future requirements of the foundry.

Our natural deposits of molding sand are fast disappearing and we must soon depend on artificial mixtures for a large proportion of our material for foundry use.

The sand mixing machines of the Standard Sand & Machine Co., and the pneumatic and power riddles shown by the J. D. Smith Foundry Supply Co., and the Chicago Pneumatic Tool Co., also mark important improvements in the mixing and tempering of sand for the foundry. The time has come when no progressive foundry can afford to do this work by hand in the way our grandfathers did. In like manner we could go on to comment on the tumbling barrels of the W. W. Sly Mfg. Co., with their dust arrester, the water tumbling mill of the J. D. Smith Foundry Supply Co., the transportation equipment of the Atlas Car & Foundry Co., the steel barrels of the Cleveland Wire Spring Co., and many other types of equipment which have come to stay, and will in the future become an important part of the foundry.

All of this foundry equipment means that in the future if we are going to put the brains into the machines in the foundry we must have a still higher class of skilled men to look after the maintenance of this mechanical equipment. For a foundryman to put in expensive mechanical equipment and then turn it over to cheap labor is the greatest folly in the world. The secret of success lies in the installing of molding machines, sand tempering machines, the most modern cupola and other special equipment, and then seeing that there is about the foundry at least one man who knows how to keep all of this equipment in the highest possible state of perfection, even though much of the labor may be of a cheaper class. If this is not done the machines will not be successful.

This brings us to the consideration of the fact that one of the topics which the American Foundrymen's Association could take up and discuss to good advantage is where and how we are to obtain the class of help necessary for making the mechanical appliances of the greatest possible use in the foundry. Molding machines will never attain their greatest use in the foundry until there is some one connected with the plant who is capable of designing match plates, stripping plates, and all of the other paraphernalia required for the most economical use of these machines, and we must devise some means for training this class of help.

ASSOCIATIONS AND SOCIETIES.

North-German Foundry Foremen's Association.

We have the following advices from the executive board of the Foundry Foremen's Association of Hannover-Linden: A call has been issued for a congress of foundry foremen to meet during the Whitsuntide holidays, in Hannover, Germany, the object being the formation of a National German Foundry Foremen's Association. A very elaborate program has been prepared, in which a number of papers and discussions on technical subjects are included. Visits to important industrial plants are contemplated, among others the large foundry of the United Emery-wheel & Machine Co., of Hainholz-Hannover. The congress will meet at the "House of the Fathers," and further details of the proceedings will follow.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Point Shirley Club, Winthrop, Mass. Dinner was served at 1:30 p. m., after which the routine business was disposed of in the usual manner, President Walter B. Snow presiding.

The secretary reported the death of Mr. George B. Buckingham, ex-president of this association, and also stated that flowers were procured and the association was well represented at the funeral. The president appointed Messrs. H. A. Carpenter, J. A. Colvin and P. Shields a committee to prepare resolutions on the death of Mr. Buckingham.

Announcement was made that the July meeting would be held in the shape of an outing to Bass Point, Nahant, Mass.

The president then introduced as the speaker of the day, Mr. Frederick R. Boocock, secretary of the American Anti-Boycott Association, who confined his remarks to the objects and benefits of that association.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

Because of the superior attractions of the national convention at Cleveland the attendance at the monthly meeting of the Philadelphia Foundrymen's Association, which was held at the Manufacturers' Club on June 6, was unusually small. Much interest was shown in the doings of the national body, and when it was announced that Philadelphia had practically been chosen for the eleventh annual convention, the following telegram was sent to Cleveland:

"Greeting and congratulations. William Penn will welcome you in 1907."

The difficulty of securing steady and competent labor in foundries, which was discussed at the May meeting, was taken up again, the topic announced for consideration being "What is the Best Method to Keep the Greatest Amount of Floor Space Occupied in a Foundry?" In Other Words, What is the Best Way to Handle the Hobo Molder So that His Floor May be Kept at Work?"

In opening the discussion, W. H. Ridgway, of Craig Ridgway & Son, of Coatesville, declared his sympathy with the hobo molders. "I believe," he said, "that the shop owner has a duty beyond his mere business. A hobo is a man who has never had a chance. He is a good molder when he is sober, and it is our duty to knock the hobo out of him. That's what we do in our shop. We have prayer meeting in the foundry every noon."

W. A. Steele, of the Bateman Mfg. Co., took the opposite view. "We have no hoboes and no blue Monday," he said.

Among others who continued the discussion without coming to any definite conclusion were Josiah Thompson, of J. Thompson & Co., and W. H. Stack, of the Genget, Cresson Co.

In the absence of President Devlin, who was attending the Cleveland convention, H. O. Evans presided, and a luncheon on the club's roof garden followed the meeting, which was the last of the season. The next will be in September.

Foundrymen's Vacation Time.

Most of the local foundrymen's and foundry foremen's associations seem to be taking a holiday for the summer, or else their secretaries are so busy that they have not reported the meetings. We have only received a report from the New England and Philadelphia Foundrymen's Associations for the June meeting, which is given below. As all of the foundrymen returned from the Cleveland convention full of enthusiasm, we predict that the fall meetings of the various associations will be better attended and accomplish more than has ever been accomplished in the past.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co., West Carson Street.

PACIFIC COAST FOUNDRYMEN'S ASSOCIATION.

J. D. Morris, Secretary and Treasurer, Seattle, Washington.

BUFFALO FOUNDRYMEN'S ASSOCIATION.

John E. Gorss, Secretary, 23 Builders' Exchange.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, care the J. L. Mott Iron Works, Trenton, N. J., Secretary.

CLEVELAND FOUNDRY FOREMEN.

H. M. Lane, 610 Schofield Bldg., Secretary.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.

C. H. Thomas, 14 Elizabeth St., So. Norwalk, Conn., District Vice President.

ERIE FOUNDRY FOREMEN.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

INDIANAPOLIS FOUNDRY FOREMEN.
W. S. Keller, of Hetherington & Berner Co., District Vice President.

HAMILTON, ONT., FOUNDRY FOREMEN'S ASSOCIATION.
A. Chase, care Sawyer & Massey Co, Secretary and Treasurer.

CINCINNATI FOUNDRY FOREMEN.
E W. Cadwell, Secretary, care S. C. Tatum Co.

MONTREAL FOUNDRY FOREMEN.
Mr. J. F. Gaffney, care of Allis-Chalmers Bullock Co.

PHILADELPHIA FOUNDRY FOREMEN
John B. Mac Meekin, The Abraham Cox Stove Co., Secretary

CHICAGO FOUNDRY FOREMEN.
Mr. Thompson, Link Belt Co., District Vice Pres

MILWAUKEE FOUNDRY FOREMEN
Sol. Shaw, care Clinton Street Foundry of Allis Chalmers Co., Secretary.

THE CORRECT APPLICATION OF TRUE BURDEN TO IRON COSTS.*

BY E. M. TAYLOR, BOSTON, MASS.

Mr. President and Gentlemen:—The subject which we have chosen for discussion covers such a multitude of sins, that is, business sins, which it has been my fortune or misfortune—sometimes I am inclined to think one way and at other times the other—to encounter in the several sections of this country which I have visited, that it may be best at the outset to make the tail wag the dog; that is, to define what "true burden" is, and then to treat of its "correct application" to first or prime costs.

A burden is a care, a worry or a trouble, an indefinable something which deepens the lines in our foreheads, a something which we are constantly trying to reduce to tangible form so that we may look it straight in the face and devise ways and means to throw it overboard or to master it before it has brought us down to mother earth in ignoble defeat.

Burden in a business sense is broadly speaking, "Expense," and "true burden" is the simple reduction into a lump sum of dollars, every conceivable dollar we spend which for any reason whatever we do not think best to attempt to apply as a part of the first or direct cost of any pound of castings we manufacture or produce.

It is the duty of every foundryman, large or small, to know what this Burden is which he is carrying, and there is no excuse today for the man who does not know.

Furthermore, in order that your business Burden may not get the best of you and in order that you may be sure that you are unloading your Burden on the customers for whose benefit you operate your plant, you must know at the end of each month what your Burden has amounted to.

To get these facts you must analyze your pay roll carefully into the general classes: productive and non-productive labor.

This means that every time one of your producers, say a molder, is called away from molding work to assist in repairing the cupola, the buildings or equipment, you must charge the time so consumed to Burden. Likewise all other labor which you cannot attach directly to the cost of each casting produced must be included in the Burden.

The same general principle applies to materials. And there are very few materials which may be classed as directly productive; that is, which may be easily measured and applied to each individual casting. Therefore practically all materials except the iron melted must be included in the Burden.

And in determining the quantities consumed each month, ways and means must be devised which will assure an equitable distribution. That is, if you buy coal in quantities to last three months, you are not justified in distributing the entire amount of the invoice into the Burden of any one month.

When you have treated your pay roll expenditure properly, and have made an equitable distribution of materials consumed, you must add cer-

*Note.—This paper was read before the New England Foundrymen's Association, May 9, 1906, and before the A. F. A., at Cleveland, June, '06.

tain amounts to cover taxes, insurance, depreciation, etc.

The grand total will represent your gross Burden expenditure for the period, and you are then in a position to handle the questions of distribution to prime costs, overhead costs, and profit or loss, in an intelligent manner and without gloves.

You have passed from the stage of blind guess to that of known facts, and if for any reason you sell at a loss you must do it gracefully and with malice aforethought.

To digress for a minute, let me recite the effect which this Burden question is likely to have on the mind of man.

It was my privilege to be called in consultation by a very able man engaged in the manufacturing business.

We spent the greater part of one day and up to about ten o'clock at night in strenuous argument over the proper items to put into his Burden, and he occasionally remarked that he didn't like that word Burden any way. The session had been lengthy and got on our nerves to a certain extent.

Several days later I saw the gentleman and the following conversation ensued:

"Young man, I've got a bone to pick with you. You remember the talk we had the other day. Well, when I reached home my family had all gone to the theater. I was tired enough to turn right in, but I didn't sleep very well.

"The next morning my wife asked me if I had anything on my mind, if anything in particular was worrying me. I replied 'no' and asked her why she wanted to know. 'Well,' she said, 'you know you were very restless last night, and talked in your sleep, and your language shocked me,' and finally she told me that one remark she clearly understood was 'Well, what in h—ll has that got to do with the Burden?'"

Now, gentlemen, so much for the Burden, and I must say that if a few hours conversation on the subject will create such an impression on a man's mind there must be something in it.

The next problem is how to apply these Burden dollars to prime costs, so that when we sell we will know whether we are getting our money back or not.

You must develop by the proper monthly cost reports what the Burden rate per hour is. That is, you must divide the gross Burden expenditure by the number of hours which have actually been put into productive work, or if for any reason it is not practical to get these hours you must develop the percentage which the Burden dollars are of the direct labor.

In other words, the Burden dollars must be distributed according to the length of time a casting is in process and not according to the weight or cost of the material used to make the casting.

To illustrate:—you start two molders to work, No. 1 on a fly wheel pattern, and No. 2 on a small intricate cylinder pattern. No. 1 completes the job in five hours and gets a casting weighing nine hundred pounds. No. 2 completes his job in five hours and gets a casting weighing one hundred pounds.

Now suppose our total Burden expenditure during the ten hours has been ten dollars.

Molders No. 1 and 2 have therefore produced one thousand pounds of castings during a period of ten productive hours at a Burden cost of ten dollars.

Now if we distribute the ten Burden dollars on a basis of pounds, the Burden rate per pound is one cent, and we would apply nine dollars as Burden cost to the fly wheel and one dollar to the cylinder.

But our cost of taxes, depreciation, supervision and all other Burden items has been accumulating during the ten productive hours entirely without regard to our feelings or to weight of the castings being produced, which means that our Burden rate per pro-

ductive hour has been one dollar and we have used up five dollars' worth of Burden cost during the time taken to produce each casting entirely irrespective of the weight of either casting.

This is the true Burden cost, and shows that on the per pound basis we have fooled ourselves to the extent of four dollars too much on the fly wheel casting, and to the extent of four dollars too little on the cylinder casting.

These, gentlemen, are the facts in regard to the "correct application of true Burden to iron costs." No foundryman can afford to operate on any other basis, and I will be very glad indeed if this brief address is of assistance to any of you.

"GOOD MOLDERS"—WHY ARE THEY SCARCE?

W. S. MCQUILLIN, SOUTH NORWALK, CONN.

Among the many problems with which foundrymen of the present day are confronted, is one which appears to demand the closest attention. This problem is the future supply of competent molders.

It must be plain to all that there is under prevailing conditions much waste of material, time and labor, a better knowledge of which on the part of those by whom they are handled could effect considerable savings.

Nearly three thousand years have passed since the time when Hiram was called to Jerusalem from Tyre to make the great vessels, columns, and certain other parts for the famous temple of King Solomon, descriptions of which lead us to the conviction that they were among the greatest achievements of the molders art, and that Hiram and those employed with him upon the work were mechanics whose skill and knowledge were of a high order.

As our minds turn back over the past and we consider what has been done, it seems only fair to expect that the skill of molder would have kept pace with the many changes and improvements which advancing civilization has brought about; and that the art would be practiced by them upon a much higher plane than it is today. It is the universal opinion among foundrymen that good molders are scarce and that they are growing scarcer year by year, and we hear much complaint that the craft in general is not up to the high standard of competence which should mark the present times. Those who are brought daily in contact with molders could give many instances that would go to show the lack of skill and ability in the average molder. Especially is this true in the jobbing shops where the endless variety in structure and design of the goods they are called upon to produce, calls for "all-around" workmen whose intelligence and judgment should enable them to successfully cope with the many difficulties encountered in the making of castings. The average molder seems to possess very little knowledge of these things, and is almost totally ignorant of the laws governing "cause and effect." We still find him working along with the same old "cut and try" methods, using his mind to little purpose and trusting always to "luck" more than to good management and an exercise of judgment, to produce results.

How often we marvel at the reasons advanced by molders to account for their failure to obtain satisfactory results. If a small part of the ingenuity displayed in forming excuses was employed to invent ways and means of preventing losses or poor work, the average of "good luck" would be higher than it generally is, or if their excuses were always thought out before a job was commenced they would seldom be required to offer them when it is completed.

Too often in the foundry, more importance is attached to "luck" than good management and a fair knowledge of the results that should naturally follow certain practices. There is abundant proof of the existence of these conditions in the business, and though there are molders whose abilities should entitle them to rank among

*Paper read at A. F. A. Convention, Cleveland, June, '06.

the best mechanics (even artists) there is reason in the belief that a large proportion of the craft are deficient in many of the qualities that would entitle them to such rank, and it would not be a stretch of truth to say that they are not mechanics in any sense of the word, much less artists. Still many of this latter class are traveling about bearing the stamp of first-class workmen, which implies that they should be entitled to all consideration as such. But their ability and true value can be discovered only after time and materials have been wasted by them in practice upon work that should present no problems that they could not have mastered in the first years of their apprentice-ship, if they had trained their minds to work out these problems.

Now if these complaints are justified there are reasons, and it appears to be the duty of all who have the future welfare of the foundry business at heart to inquire into the causes responsible for these conditions, and in line with the educational, and advancing principles proclaimed by this association, do what may lay in their power to remedy the difficulty.

Are there reasons connected with the business that the foundry attracts only human material that is not fitted for other vocations, where the exercise of brains and a certain standard of pride in work, is required? Are there so many more inviting positions open to young men of ambition and intelligence that the foundry can secure none but those whose only qualifications seem to be ability to stand hard work under the many disagreeable conditions to be experienced in the dirt and smoke incident to foundry procedure? This while on all other sides appear the evidence of light, clean and pleasant employment with opportunities of advancement or at least an occupation at which they will be able to earn a living in their older years.

Is there nothing to show that this industry is one that demands abundant talent, and that in spite of the features that appear disagreeable, its followers have many opportunities of advancing far above the level of common labor. Does the appearance of the conditions mentioned keep away the good stock of which mechanics are made, or does the actual existence of these conditions in the foundry blunt and destroy all desire for knowledge and advancement with which the average human being is endowed?

Is the modern foundry practice of specializing, and the introduction of the molding machine, a cause of the wanting competence of the molder as a mechanic? Does the practice along these lines keep a man down to the level of the common laborer of whom no more is required than a certain set of motions in which the mind takes very little part? Is this the class of molders that the business is producing, generally? The foundryman of the present day is confronted not with a scarcity of molders well developed, strong, able, and willing to work, but with a scarcity of molders well developed mentally, able, and willing to think.

It seems proper that we should here ask, to what extent foundrymen themselves are responsible for the scarcity of good molders. Are the conditions imposed upon men working at the trade such that they have no chance to develop their minds as well as their muscles, both of which are so important to the production of a paying quantity of good castings? Is the ever straining and crowding to produce a quantity, that will enable foundrymen to compete with each other for a low price, one of the factors which tend to get a molder into the habit of disregarding the many things so important for the production of quality? Is competition (which we are told is the life of trade), the desire and determination to produce more castings for less money than some other foundry, a cause that contributes to this scarcity of good molders?

It is to be feared that there are many foundries in which the facilities and equipment is by no means up to date, and still molders are expected to produce castings in competition with others in which modern improvements

and up to date methods have been acquired.

What premium is usually paid talent and intelligence when it is met with in the foundry? Is it always appreciated and encouraged? Are the bright and faithful men and boys always given opportunity to exercise the talents they may possess? Are they not often kept within such narrow limits for the sake of convenience and profit that there is small chance for them to expand to the proportion that would fill the void of which we complain? Has the foundry business been made so unprofitable by the low prices, and degenerated to such a condition that only an inferior quality and a superior quantity (which usually go together) can be made to pay?

Much has been written and told relating to irons, fuels, cupola practice, and cost keeping and to show by a more or less thorough analysis of these subjects, how and when the best results may be obtained.

So well have these matters been discussed that in many foundries, that the importance of the melter has far over-shadowed that of the molder. It is true we often read the details of the molding and casting of some important piece of work. A great deal is told of how the different parts are made and handled, but as a rule we are shown only the physical operations of the work, while we are often left to guess the reasons why certain methods are employed. Indeed frequently less notice is given the molder who does the work, than is paid to the ladle or crane by which it is poured.

Now while not belittling the abilities of the men in charge, the credit and glory of the achievement usually goes to them, and little tribute is paid the molder for the part that he has taken in successfully managing the many details of the work. It does seem that a little share of this glory should be accorded him for his part, even as a matter of policy, as it is a law of human nature that man will strive for greater achievements for the sake of fame than he will for pay, and full appreciation seems really a small price to pay for honest effort.

Regarding competition: The foundry is fast undergoing a revolution in which many methods of a few years ago are being abandoned, and much of the work that has been done by bodily labor more or less strenuous, is now being taken care of by machinery. In the future the up to date foundry will not experience so much trouble from the scarcity of good molders, as the most intelligent will be attracted to them. They will there find many opportunities for using their brains, while steam air and electricity will do the rest. The foundries that have not kept pace with the times will get only those of little use to anybody and will be obliged to work them harder to make a showing in the competition with their more advanced and up to date rivals.

Man is by nature a thinking animal and those who possess considerable intellect, are not looking for jobs in which ability to perform physical labor is the principal requirement.

Recognizing these facts, it must be plain that the successful foundries of the future will be those in which the greatest amount of hard labor and disagreeable conditions have been eliminated; and those who choose or feel compelled to remain in the old rut, will always experience the scarcity of good molders, or if they do secure them will pay a high price for their product.

In connection with these subjects, the sanitary condition of the foundry should not be overlooked as having its influence upon the help. For "Cleanliness is next to Godliness." It does not seem necessary to enlarge upon this, as we all recognize the elevating influence of clean and healthful surroundings.

Before closing, it might be interesting to note that the establishment of trades schools for learning the art of molding have been more or less widely advocated, in which young men of promise might be taught the rudiments of the business, while earning a living and keeping the institution upon a paying basis. In the absence of the re-

sources necessary for the establishment of such institutions, would it not be wise to make some practical application of the suggestion to the foundries that are already in operation? It certainly seems that some more effective and advanced methods of educating molders than those now in vogue must become a part of the foundry business in the future, if there is to be a higher standard of efficiency in the trade.

The time is not far distant when a vast deal of the work now requiring more or less skilled molders, will become specialized and handled in greater volume by special methods and machines, requiring little skill to operate. In spite of this, however, there is, even in the dim future, no indication that thoroughly trained, and educated mechanics will not be needed. On the contrary while mother earth continues to give up the bountiful supply of metals used in casting, there will be a demand for "good molders."

MULTIPLE MOLDS.*

BY JAS. F. WEBB, ELKHART, IND.

The first cost of rigging up for the multiple mold is not a great deal. You can use the same patterns that are used in a snap flask, the only change to be made is to put on two pins on the pattern board to the fit pin holes in the flask; and to put on an upright gate to connect the molds. It is good policy to have the upright gate ¼" shorter than the depth of the flask, and to cut through with the sprue cutter after drawing the pattern; if it is full length it interferes with the presser head. The next thing is to make a set of iron flasks. This is for molding machine practice. It is best to use iron flasks here as there is less chance for discount.

In railroad shops there is a wide range of work that can be made in the multiple mold. Fig. No. 5 shows some of our patterns rigged for multiple molds, all plain on top. In molding a 12"x 16" snap flask, 4" cope, 3" drag, there are 1344 cu. in. sand used to ram it up. In a 12"x16" multiple mold 3" deep there are 576 cu. in. of sand, showing a saving of over 57% of sand to handle which is no small item in the course of a day, both in preparing it in the morning and handling it in the molds. Besides this there is the saving of floor space.

Twenty-four snap flasks 12"x16" require a space of 32 sq. ft. to place them on the floor. Two multiple molds twelve high require a space of 4 sq. ft., allowing 4" between handles on the flask to operate them, which gives plenty of room for this purpose. This represents a saving of floor space of 87½%. When business is good and room limited this is quite important.

Fig. No. 2 shows the comparative saving in floor space. Furthermore it illustrates how a great deal of hard work in pouring off is done away with. Snap flasks are commonly poured with a hand ladle of about 45 lbs. capacity. Multiple molds may be poured with a larger ladle, sav 200 lbs. capacity. An overhead trolley is a handy thing to have in pouring off.

Twenty-four snap molds that weigh 15 lbs. each mean 8 hand ladles for the molder to carry, and the same number in multiple molds means 2 ladles of 180 lbs. capacity to pour which makes it a great deal easier. (See Fig. No. 2 and 4) and the discount is not a great as in a snap flask, the loss being about 1%.

More patterns can be used in a flask, for they can come closer to the edge of the mold without danger of running out. See cut Fig. 5 as to quality of castings. We have patterns, where in a snap flask, twelve were as many as could be put in one mold, while in a multiple mold we now have eighteen, an increase of 50% output to each flask.

When making a multiple mold, the iron flasks must be arranged with a rib extending in about ¼" on the inside to hold the sand in the flask. When closing it down place the flask on the pattern board with the rib up, so that after it is rolled over it will be on the bottom. Have an iron frame to fit the top of the flask ¼" deep; riddle sand on your pattern and fill the flask flush with top of the iron frame. Put the presser head on and press your mold. Then take the frame off, strike off the sand even with the top of the flask, throw a little loose sand on top and rub down with a finish board,

*Read at A. F. A. Convention, Cleveland.

FIG. 1.

FIG. 2.

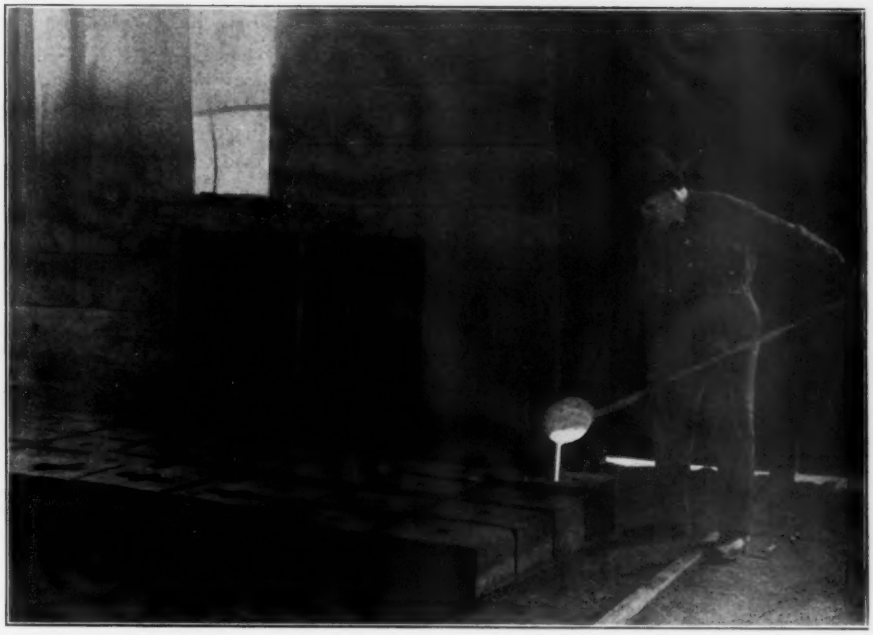

FIG. 3.

FIG. 4.

roll over, draw the pattern board and cut the gate, and place the mold on top as Fig. 2 shows. In making the bottom part of the mold use a regular bottom board and stop off the upright gate even with the other gate.

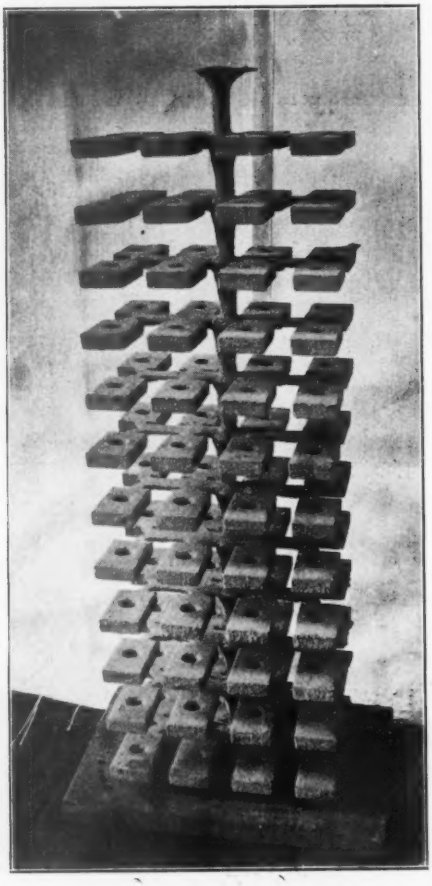

FIG. 5.

We are using the Farwell molding machine to advantage in making multiple molds, and as it is not a high priced machine it will not cost much to try it out. One of them is shown in Fig. 1 with some of the patterns we are using in the multiple mold in connection with patterns we have on boards. We are using a brass frame on the outside of the board fastened at the corners.

The vibrator, which does away with all rapping by hand, we secured from E. H. Mumford & Co., who had just what we wanted and only cost $10.00. I don't know how we could get along without them, frame and vibrator attached being shown in cut Fig. 1 on the machine with knee valve fastened to lift the table at the right hand side.

In making these molds the gates leading to the casting want to be small enough to allow the iron to congeal and get set so as not to cause any undue strain or pressure. The metal in bottom mold gates want to set before the part above is filled. In making these molds it must be remembered that there are no bars in the fiask, as they would interfere with shaking out. There should be enough sand under the pattern to keep it (the sand) from falling out. With a flask 3″ deep we are making six castings in a flask 1″ thick without any trouble, This allows 2″ of sand under the pattern.

One further advantage is that the molder can continue to mold after the blast is on, for he knows he can pour off in a short time, and that he will not have a lot of hand ladles to carry. I feel certain that any railroad shop can use this way of molding to good advantage, not to mention any other line of work.

DARK SECRETS IN FOUNDRY PRACTICE.*

BY WM. H. PARRY, BROOKLYN, N. Y.

In these latter days we are becoming quite accustomed to congratulate ourselves on our wonderful progress. In many lines of endeavor this is certainly true; and while the foundry practice of our country will more than compare favorably with that of any other nation, yet there is a tendency, in some quarters at least, to throttle progress by guarding trade secrets (?) for fear of financial ruin.

Let us consider a few practices in foundries still prevalent, from the viewpoint of a looker-on, rather than as a foundryman. In Hoboken, N. J., last June, there was given an exhibition of a new method of making gray iron castings in iron molds. This statement in itself is not startling, for it is done frequently enough. But in this case the castings when cool enough to handle were also soft enough to drill

*Read at the A. F. A. Convention, Cleveland, June, '06.

and file. In this particular instance the castings were four-inch soil pipe elbows, averaging a quarter of an inch in thickness. The mold in question was a three part affair, the two upper portions being hinged to the lower, and making between them, when closed, the outer form of the elbow, and space for the sprue and riser. A green sand core was used with an arbor designed to set firmly at the ends of the mold.

Just previous to the commencement of casting operations, the mold was coated with a mixture known only to the inventor. Then the mold was heated long enough from the inside, by placing sows from the first tap of iron, until the heat penetrated to the outside. All dirt was blown out, and the third act of the comedy took place. This was the application of another coat of liquid, which it is hardly necessary to state was also a dark secret. The green sand core was placed in position, the mold closed and locked, iron poured in, and in a few minutes the mold was opened, the sprue and risers knocked off, and the casting taken out. The operations were then repeated several times, with the exception that the mixture was not used, this being guaranteed to last a day.

An examination of the castings showed that at the farthest point from the sprue, at the outside, were innumerable cold shuts; in fact, the castings were not by any means first-class, though this was the very thing claimed for the process.

In this, as well as many other attempts to improve foundry methods, the practical side was entirely lost sight of by the promoters. Supposing the mixtures and liquids were all that was claimed for them, the use of the iron molds would be limited to repetition work of the simplest kind anyhow. Their relatively high cost, and possible short life due to distortion, would not tend toward economy, and continuous melting and a plentiful supply of molds would be necessary, to say nothing of the fact that the core had to be made in the ordinary way.

It seems a pity indeed that the ingredients of the twin liquids are not known for our edification, and that a harder iron than the one used was not taken. With the iron running silicon 2.34, sulphur 0.07, phosphorus 0.280, manganese 0.44, combined carbon 0.26, graphite 3.27, it will be seen that with a hot iron mold, likely coated with powdered aluminum, and a regular green sand core, an iron of this composition could not come out hard, whatever its physical characteristics due to casting into a metal mold.

In the diamond polishing industry, a small proportion of which this country is permitted to share with Belgium and Holland, through the importation of operators and material from those back-number countries; there is a little item in foundry practice that is worth while delving into. Not because of its commercial value, which is nil, but rather to show up a foundry octopus in this age of trust exposures.

All diamond operators are united in the belief that the metal disks used for cutting and polishing diamonds can only be made in Holland or Belgium. For they naively say, the secret of the composition has been kept in certain families for centuries. The disks in question are about 11½ inches in diameter, and ⅝ or ¾ inch thick, and are rotated at a very high speed in a horizontal plane. The upper face is smeared with a mixture of olive oil and "bort" or diamond dust. The stones to be polished are placed about this disk, weighted, and in due time are ground down to the desired shape.

It is conceded that the best wheels are made in Antwerp, by DeWinter & Son, and an analysis shows that all that is required is a good grade of open-grained cast iron. The necessity for the open-grain is to provide minute pockets for the lodging of the diamond dust while performing its functions. In other words it is a case of "diamond cut diamond." Perchance some day a member of the American Foundrymen's Association may be called upon to specialize in diamond polishing wheels, so here is the analysis of the

castings:—Silicon 2.70, sulphur 0.063, phosphorus 0.302, manganese 0.44, combined carbon 1.60, and graphite 1.37.

In making castings that require a chilled surface there appears to be a lack of knowledge, or at least a lack of the desire to part with that knowledge on the part of those individuals who may be fortunate enough to possess it. There should be determined once for all what results are obtained from a given mixture cast at a given temperature and against chills of a certain thickness, with the range due to variations in each. This problem does not seem impossible of solution and the tables thus constructed would be invaluable.

Having some experience with chilled work on small castings where the chills were used solely to insure solidity at a certain spot, the statement was made to me by a foreman to whom complaint was made—that the last lot of castings were porous—that the chills were probably too old. Upon investigation it was found that the chills were free from fire-cracks, and otherwise in good shape though used intermittently for some twenty years. Drillings taken from the side of the chills on the contact side gave:—silicon 2.07, sulphur 0.073, phosphorus 0.0312, manganese 0.48, combined carbon 0.23, and graphite 2.41. From these figures it would seem that while the chills were almost old enough to vote, that were not decrepit by any means.

To Mr. H. E. Diller, the secretary of the Metallurgical Section of the American Foundrymen's Association, is due the credit for the analyses generously contributed by him for this paper.

RECENT METHODS OF MACHINE MOLDING.*

BY E. H. MUMFORD, PHILADELPHIA, PA.

I realize that I have said and written so much about molding machines that anything more from the same source would be unwelcome, as lacking in novelty, were it not that, like any explorer of terrae incognitae, I have but to describe what I have seen to be credited even with originality.

It is because I feel that I can tell you of some new things and some new combinations of old things, which I think are to make the year 1906 one memorable in the history of machine molding that I venture to address you again.

I may as well mention the fields of development, taking up the detail in those fields as I go. You will at once say that the *fields* are well known.

Broadly, this is true, for they are as follows:—

1. Rock Over Molding.
2. Jolt Ramming,
3. Match Plate Molding,
4. Multiple Molding.

So far as I know, Rock Over and Multiple Molding by machines are ten years old. Jolt Raming is over twenty years old, and Match Plates are the oldest thing in machine molding.

From the hinged flask to the first Rock Over Machine was but a step. Put the pattern on a Match Plate and hinge it from a point outside the flask area, with a counter-balance spring or weight to help handle the weight of plate and pattern, and a simple spring clamp to hold a bottom board on, and you have the earliest good seller in the Rock Over Machines. Its shortcomings are its radial pattern draft, which causes the pattern to bite off sand walls near the hinge especially, and the considerable error introduced by landing the mold on a more or less uneven bottom board. Mistakes have been made by designers putting brains and money into accurate pattern draft mechanism on machines, and afterwards vitiating all their designs by obliging their gear to draw a pattern from a mold which has tilted over on an uneven bed. You may know without trying that any machine that places a mold from which it is to draw a pattern on its back on a bottom board of any description and then draws the pattern regardless of the new plane of the mold joint will not be satisfactory on work involving any appreciable pattern drawing accuracy; and, even on the simplest work, if an absolutely clean lift is wanted, this inherent error will prevent it.

*Read at A. F. A. convention, Cleveland, June, '06.

Before going further, I may as well state that much that I mention in this paper either is already or will be patented, the foundry trade should be grateful to our beneficent Patent Law that allows public use and advertisement of a new idea without sacrifice of a Patentee's rights, for, by this condition, the trade get the use of the new machine just so much the sooner. It may be regrettable that enterprising foreign foster-mothers proudly adopt as their own promising American off-spring; but, after all, these infant wanderers seldom thrive away from home and the main regret is that they should be so abused and maltreated as to get an undeserved reputation for inanition. Of course, it is well understood by members of this Association that it is best to avoid appropriating other people's ideas which are in process of development for patents, and I will, therefore, not hesitate to tell you some of the good things I know.

A decided improvement in Rock Over Machines has been introduced by giving the hinge of the Rocking pattern support a rectilinear guide intended to be normal to the mold joint in its line of draft. This has been a most valuable innovation, but at present has in it the fundamental error I have referred to, of trying to get a fair lift from a mold lying on a bottom board, with a fixed pattern draft.

There are several easy ways of avoiding this difficulty, and one of these is already in use. I refer to taking the datum for the pattern draft from the joint of the flask. The half flask lies on its back on its bottom board, and the pattern is drawn by guides resting on the joint edges of the flask. This is the correct method and deserving of success.

Jolt Ramming.—Jolt Ramming is 20 years old in this country. If you consider merely the bumping of a mold to ram or partly ram it Jolt Ramming is as ancient as molding, for all bench molders have had occasion always to pick up a flask and bump it upon the bench to settle sand in the pockets. But, practically 20 years ago, S. Jarvis Adams had power Jolt Ramming machines running in Pittsburg on small deep flasks.

So it is not, in itself, a novelty, though some of the early patents upon it having now lapsed, its public use is only recently being advertised.

The canons of success in Jolt Ramming are:

A dead drop,
A firm, solid machine,
Center of impact under center of gravity of falling mass.
Impact always central.

Until recently, Jolt Ramming Machines which draw patterns as well as ram molds, have combined both functions in integral mechanisms and have been capable of ramming in only one way. Now, machines may be had which separate ramming from pattern drawing so that the ramming and pattern drawing elements may, if desired, be separately and simultaneously used, and, as a consequence, a variety of pattern drawing elements—or what are commonly called "Hand Ramming Machines"—may be used upon a single Jolt Ramming element.

Most of the work which it pays to Jolt Ram is so deep that, to draw patterns, stripping plates are required. To change stripping plate patterns on a machine requires considerable time. It is, therefore, often convenient to keep a set of stripping plate patterns which are frequently used, permanently fixed upon a pattern drawing machine. Moreover, there is no good reason for keeping an expensive Jolt Ramming Machine idle while men are changing patterns on a pattern drawing machine, which may just as well be separate from it. Furthermore, a man may purchase a single Jolt Ramming Machine, and add to it a variety of sizes of pattern drawing machines, and even use several of them at the same time on a Jolt Ramming Machine of sufficient capacity.

Ordinarily speaking, the cylinder of a pneumatic Jolt Ramming Machine is only large enough to raise promptly the weight imposed upon it. There is, however, no reason why this cylinder should not also be large enough to press a mold and be subject to the control of an automatic valve for Jolt Ramming and, at the next operation, to an ordinary throttle valve for press-ramming.

To illustrate, take a grate bar. The pattern is all in the drag, and is of such a nature that Jolt Ramming is best, but

the cope is "flat back," and must be rammed *upon the drag mold* and pattern, sand to sand.

This is something Jolt Ramming cannot do. The pattern in the drag will settle down in the sand away from the joint, so press-ramming is necessary. A machine is now built for this use.

Match Plate Molding.—I know you will say that this fell so long ago from the tree that the chestnuts cannot even be found in the burr! But don't forget that many a chestnut has grown a new tree!

Match Plates date from the good old days when molders actually did their own thinking, and studied out ways to save their employer's time. Theirs is an honored name, yet so many troubles have been laid at the door of match plates either ill-adapted for, or misused in their work, that many a man quits listening when you say match plates to him and begins to do the talking himself.

Probably the first successful use of Vibrators was in connection with single sided match plates, and there have been many applications of the match plate since then to machine molding.

The making of match plates with patterns cast in their surfaces by a process which constitutes the plate a fin of ¼" or more around the casting of the pattern is very old, though not even yet known to all foundrymen. In forming the edges of such a plate, any desired shape may be given to the casting. For instance, about six years ago aluminum match plates were cast with rabbetted edges to fit frames surrounding them, which carried the Vibrators and flask pins, and, with that, now, there is little, if any, excuse for continuing the use of patterns feebly attached to the gates which run the castings.

This leads me to comment upon the fact that the match plate is deservedly rapidly displacing gated patterns in these days of speed in machine molding, for the gated pattern requires the sand match or odd side and separate ramming of cope and drag, which the match plate does away with.

Given a gate or spray of master patterns, and an aluminum match plate with edges fitted to go in a Vibrator Frame, may be prepared now in an incredibly short time by a new process which I am not permitted as yet to fully describe.

While speaking of match plates, if you will allow me, I will mention an arrangement which is not yet completed and working, for the simple reason of lack of time, but the working of which is so simple, though, I believe, so novel that I think you will pardon my speaking prophetically of its success.

It is simply a hinged match plate in a hinged flask. Hinged flasks are no novelty, and match plates would undoubtedly long ago have been used in hinged flasks, except for the disposition of the thickness of plate in closing, and the freeing of the hinge so as to get the match plate away. We give the flasks a double pin hinge and put the hinge of the match plate in one of them, so that the cope hinges on the plate until the pattern is drawn and then transfers its weight to its second hinge pin to free the plate. The plate is then hinged out of the drag and taken away, when its hinges are so arranged that the cope closes in perfect registration on the drag.

This method of molding avoids all handling of loaded flasks and reduces the "machine" to nothing but a match plate.

As a *hinged* match plate, however, it is limited to such patterns as will hinge out of both cope and drag, and is not for deep work.

Multiple Molding.—If I presented no development of Multiple Molding beyond what has been know into the trade for some ten years, there would be little excuse for saying anything about it, but almost as much has been done in the last five years as was done in the first five of the approximately ten years of Multiple Molding.

The first Multiple Molds were just ordinary two part molds, piled one on another, with a sprue hole cut through the drag part into the cope part of the mold below.

Next came the thought of utilizing the idle joint between a drag part and a cope part.

It at once became evident that, in order to make this kind of Multiple Molds, it was necessary to ram both top and bottom faces of the Multiple element simultaneously. This meant that the drag patterns

should be rammed down into a block of sand while the cope patterns were being rammed *up* into it. The impracticability of pressing a pattern down into a struck surface of sand had, long years before, been shown in the operation of a machine in Scotland in which a double-faced match plate was swung in edgewise between cope and drag flasks, the drag flask already filled with sand, the cope flask filled with sand dropped upon the pattern. In this machine, just as in Multiple Molding, until recently, the greater depth of the pattern had to be in the cope, and for the same reason—the common difficulty of getting sand *up* around the pattern, against the universally downward tendency of all things.

In 1902 Mr. P. D. Beckwith, at Dowagiac, Michigan, made a great improvement in Multiple Molding by providing for filling the drag pattern while inverted and then holding the sand up against the drag pattern while turning it back upon the sand already filling the flask upon the cope pattern.

Although doing this accomplished for the first time the ramming of deep drag patterns in multiple, yet the time occupied in handling the drag patterns separately was sufficient to very much reduce the otherwise rapid machine molding. There remained, however, the large saving in floor space and in sand and flasks inherent in Multiple Molding.

It would surprise the many who carp at Multiple Molding as a fad that has run its course to visit Dowagfac and see the kind of work Mr. Beckwith is making in this way.

And now comes Rathbone, with his new principle of neutralizing gravitation by causing the unrammed sand in the flask with excess sand enough in the removable sand frame over the flask to allow for compression to move *up* against and around the drag patterns fixed to the Ramming Block of the machine with velocity equal to what it would have had if it had fallen in upon them.

By this means, Rathbone sets the loose sand up around his pattern before ramming in an instant of time and just as effectively as though accomplished, as of old, upon an inverted pattern. In other words, he gets the drag mold practically instantaneously without the heretofore inevitable rolling over either before or after ramming.

If you will consider carefully what this means, you will see that a complete mold is formed by as simple and quick a process as is employed in other machine processes for forming the drag half alone.

As yet, the Rathbone process has been operated without time savers such as hopper-fed sand and automatically struck sand faces. But, notwithstanding this, sixty 14″x16″ or 13″x18″x4½″ molds an hour are easily made by one man who shovels his sand from the heap and stacks his finished molds eight or nine high.

As a rule, the flasks used for Multiple Molding must be about 15% deeper than the half flasks used in ordinary two part molding. This is because each flask has half of the cope and half of the drag patterns in it, and must have sand enough in its depth to allow for this.

Work of about 2″ total depth is usually piled nine molds high in flasks 4½″ deep. That is ten flasks—nine molds—in a pile.

The saving in sand and flasks accomplished under these circumstances is:

$$.85\left\{\frac{18-10}{18}\right\}37=\%$$

The saving in floor space is:

$$\frac{9-1}{9}=88\%$$

Most foundrymen think that the castings at the bottom of a pile in Multiple Molding must strain, owing to the ferrostatic head of, say, 45 inches.

Two things should be considered before assuming this:

First.—That never were molds so perfectly clamped and weighted as those at the bottom of a stack of nine molds. If sand rammed as a liquid, and the same ramming pressure laterally as vertically might be assumed, the liquid iron would find walls of sand all about it set up at a pressure of at least 40 lbs. per square inch and held against displacement as never before. This iron, standing in a liquid column 45 inches high would exert a pressure less than 12 lbs. per square inch, so that, unless the walls of the molds yielded to such a pressure, and they would not, there could, even then, be no straining. But, the second consideration is that

the usual guarantee against strained castings is had by so reducing the section of the gate which leads the metal to the mold as to insure its having set before the column of metal in the sprue has risen to a height sufficient to put an excessive head on the mold.

While there are many more new methods of machine molding which I might mention, I believe that in the main the most interesting have been referred to. The perennial search for permanent molds is being made and it is barely possible, that, for light work, a permanent mold of refractory material that will allow a casting to shrink in it without pulling apart or that will follow the vagaries of cast iron in its process of crystalization may be discovered, but the problem is not an easy one, and I am inclined to think that for a long time to come green sand and a strong back or a good machine will produce most of our smaller classes of castings in large quantity.

UNIFORM PRACTICE IN FOUNDRY COST FINDING.*

BY KENNETH FALCONER, MONTREAL, P. Q.

To a certain extent I have accepted your secretary's kind invitation to submit a paper to this convention, and to meet in Cleveland the members of the American Foundrymen's Association under false pretenses, for I am neither an American nor a Foundryman. These are misfortunes not faults, which I have to some degree overcome, inasmuch as I have the happiness of having an American wife, and the honor of belonging to the American Foundrymen's Association.

The saying that this is an age of "Specialism" is so common as hardly to be worthy of repetition: that it is an age of standardization of methods—of uniform practice—is equally true, though less frequently stated, and perhaps less generally recognized. The existence and growth of associations of those whose work is similar, or whose interests lie in the same direction is in itself an evidence of this: the logical influence of conventions and meetings of such organizations is towards the general adoption of certain principles, the details of their application being subject to individual conditions and special requirements. As a result of this convention, different members of this association will, during the coming year be thinking along similar lines, and adopting, in relation to certain features of their business, similar methods with similar ends in view. It may be possible that some degree of uniformity in cost finding methods in different foundries, and in different plants, whose interests are represented here, would result in general good to the trade. The Steel Founders Society of America, have in the recent past, taken up the subject of "Uniform Methods of Cost Finding for Steel Foundries," and those connected with each line of manufacture, or interested in each branch of industry might possibly consider with benefit the advisability of adopting in their different plants methods of Cost Finding uniform in so far as general principles are concerned, though possibly widely different in details.

"Competition is the life of trade," but this is only true in so far as it relates to intelligent competition, based on accurate knowledge of the results of previous operations and transactions. Unintelligent competition based on guesses of costs or on rumors of competitors' prices is the ruin of trade, and the death of industry. Uuprofitable business is frequently accepted with full knowledge of its undesirability, but in the majority of cases such a course is necessitated because some other concern has submitted a quotation based on incorrect and misleading methods of Cost Finding and of estimating. A long step will have been taken towards eliminating such competition in any line of manufacture if the basic and underlying principles of Cost Finding, which are properly applicable to such line of manufacture, be uniformly adopted, the details connected with the application of such principles being worked out to suit individual conditions and circumstances.

*Read at A. F. A. Convention, Cleveland, June, '06.

It goes without saying that no system of Cost Finding can be designed for the manufacture of castings, or for any other business applicable in all its details to the plants of competing concerns, but the fact remains that similar principles of Cost Finding, and the broad application of such principles on similar lines are applicable in all plants manufacturing similar products, and the resulting influence will make for healthy and normal competition, instead of disastrous rivalry.

To standardize methods of costing and estimating in any industry, a clear understanding of the term "Costs" as applied to manufactured product is essential. To some it means only the value of material and labor consumed, to others it includes expenses incurred in running the plant, while the elect take it to cover in addition all expenses of selling and of administration, and in some cases all possible outlays.

While the division of each plant or organization into its component departments might involve in each instance different definitions of departments and limitations of authority, it would make for more intelligent estimating for competitive purposes, if competing plants were departmentalized in the first instance on similar general lines. All the departments of a productive organization are, naturally, capable of classification as manufacturing, selling or administration, this logically resulting in three costs, which may be defined as cost manufactured, cost sold and final cost. If all bids and tenders were based on accurate knowledge of these three costs, members of the trade interested would, to a greater extent than at present, have only fair and legitimate competition to meet. The methods of obtaining records of labor and material costs would necessarily be determined in each plant by the individual judgment of those in control, as would also all other details of cost work. Cost of material is practically governed by market conditions, and cost of labor too frequently regulated by forces beyond the control of the management, and there is, consequently, in these two factors but limited opportunity for cost reduction. In Expense Cost of product lies the greatest opportunity of effecting economies, and it is this factor of cost which should be thoroughly analyzed, and closely watched so as to keep it down to the lowest possible figure. To do this, the amount of each expenditure going to form the aggregate Expense Cost of product should be known very promptly after the close of each period,—week or month, as the case may be,—and should be subject to constant comparison, not only with similar records of preceding expenditures, but also to items of related interest.

The basis on which manufacturing expenses are distributed on cost of product is a point regarding which, in Canada at least, there is little uniformity of practice amongst foundrymen. Some distribute such expenses according to the weight of output, some on the labor and material cost of product, some on the ratio of Manufacturing Expenses to the value of productive labor, and others again on the ratio of Manufacturing Expenses to the number of productive hours worked, irrespective of the wage price per hour. Competitive bids based on cost records secured by such widely different methods constitute unsatisfactory competition, are demoralizing to the trade interested, and are a strong influence towards creating unsatisfactory and unstable market conditions. This subject might with advantage be discussed, and possibly some uniform practice adopted by those connected with the same line of manufacture, and interested in the same branch of industry.

Uniform accounting methods are perhaps more important than would appear at first sight:—not so much uniformity as between different plants, as uniform methods to be used continuously in each plant. If a foundryman or manufacturer distributes his expenses during five different years according to the five different plans, previously mentioned, the value of his records of costs and results for those years is largely destroyed. This is

not intended as an argument that present methods should be continued, simply because "We have always done it that way," it is meant as a plea for a very thorough consideration of the subject, and a determination in view of the conditions of each plant and business of what is the right and logical method of distributing expenses on product, of obtaining costs, and of carrying the results into the books.

DEVELOPMENTS OF THE THERMIT PROCESS IN FOUNDRY PRACTICE.*

BY W. M. CARR, NEW YORK CITY.

During the last convention there were presented to your notice a few explanations and experiments outlining the Thermit process. In the interval since that time a diversity of accomplishments have been attained in actual practice, too numerous to discuss exhaustively in the limited space of a single paper. Reviewing the experience, a few of the principal and representative practices will be touched upon.

Most of you no doubt have at least some acquaintance with the reaction of the Thermit compound, which evolves such a convenient, condensed supply of heat in such a simple manner and of pronounced practicability; a high range of temperature not to be had by any other means known to iron foundry practice.

The practical results reached with the assistance of heat produced by Thermit can be mentioned as follows:

In a number of cases where it was important to pour light, thin sections and where the metal was rather dull, the desired increase in temperature and fluidity was gained by an addition of Thermit placed in the bottom of each hand ladle into which the iron was poured from the bull ladle. The Thermit having been primed with the necessary ignition powder, immediately reacted and because of the well known heat, the object sought followed. In this way the castings were free from cold shuts and there was the satisfaction of the foremen in seeing respectable reports with a minimum loss from scrap or defective castings.

Along similar lines in a well known and important steel foundry, recourse was had to the calorific value of Thermit bringing about results that had never been obtained before. The plant was equipped with a single 2-ton Tropenas convertor and only one 5-ton ladle. It was desired to pour some ingots and castings requiring twice the capacity of the convertor. Attempts had been made to make two heats separately and pour them both into one ladle. Much difficulty was encountered by the first heat chilling, while the second heat was being blown to the extent that the ladle was heavily skulled by cold steel, causing much loss and annoyance. The drawbacks to this method of making "double blows" were overcome by keeping the first charge of steel hot and liquid by the insertion of Thermit cartridges attached to iron bars and plunged to the bottom of the ladle at regular intervals during the progress of the second heat, which occupied about 45 minutes. When the second heat was poured into the ladle holding the first one treated as described and after pouring a few castings and finally the ingots, the ladle was found to be entirely free from skull, proving that a good temperature had been preserved by the Thermit heating compound. As mentioned, this result had never been accomplished before in this particular foundry when "double blows" had been attempted.

In the treatment of large headers—both iron and steel—the application of Thermit in suitably sized cartridges has kept them open longer and produced a better feeding effect than any other known means.

In the manufacture of semi-steel castings, two uses have developed from the agency of Thermit. First, when the necessary steel is melted in the cupola with the regular charge, the insertion of a semi-steel Thermit car-

*Read at A. F. A. Convention, Cleveland, June, '06.

tridge in the ladle produces a poling action, which thoroughly mixes the metal with no loss in temperature, because the heat of the burning compound more than offsets any possible chilling effect when poling may be done. Second, if it is desired to make but a few semi-steel castings among a larger number of ordinary castings, steel borings or chips can be put in the ladle bottom, the iron tapped in, and by the insertion of a semi-steel cartridge the steel will be melted and thoroughly and completely dissolved in the iron. This obviates the necessity of making special heats for occasional semi-steel castings.

Concerning repairs to castings in gray iron work, the general practice is to greatly raise the temperature of a quantity of molten iron by an addition of Thermit and applying the iron so regenerated in the usual manner of "burning on." In this way the repair is effected by much less iron than would otherwise be required and there is greater assurance that the weld or fusion of the parts will be better than under ordinary conditions, for the simple reason that the iron used for fusing, and treated, is hotter than it generally leaves the cupola.

Repairs to steel castings in open-hearth plants are obtained by the direct application of the steel produced by the Thermit reaction. Repairs so made, under conditions where due attention has been given to such precautions as cleanness of the parts, a pre-heating of them and dryness of mold, stand inspection when the specifications as to reliability are most rigid. The process is in daily use in all progressive and well ordered steel foundries. In Tropenas plants the practice is to follow the same plan as in grey iron foundries—to pre-heat the steel by Thermit and make the welds by it. This is possible, because they are equipped with small ladles and have the advantage of much hotter steel from the convertor to begin with, than the open-hearth foundries.

An interesting point brought out by the use of the Thermit heating compound, is that it has been found that the effect of the compound upon molten cast iron is to cleanse it, close the grain and materially increase the strength not unlike that produced by titanium Thermit. The action is no doubt due to the heat developed, which must increase the fluidity of mechanically or chemically fixed impurities and bring them to the surface. Not enough is added to sensibly change the usual chemical composition with the mild steel produced by the reaction. The improvement in properties mentioned can then only be reasonably explained by the beneficial action in fusing off possibly dissolved oxides or impurities. It is recognized that there is a need for some agent to bring such removal about, because it is generally agreed that molten pig iron can carry some form of oxides more or less objectionable. Possibly the advent of the Thermit process may offer a solution in that direction, since the results as cited point that way.

These points are only mentioned with the hope of interesting you and to show you that progress is being made hand in hand with the spirit of the times, the lessening of uncertainties, the elimination of losses, improvement in product and peace of mind of the foundryman.

PERSONALS.

Prof. Sydney A. Reeve, of Worcester, Mass., has resigned his position at Worcester Polytechnic Institute to devote his time to private consulting engineering practice. For ten years he has been professor of steam and hydraulic engineering and is well known as a specialist along these lines. Prof. Reeve will not give up teaching entirely, as he will continue to give a course of lectures at Harvard University.

The Warren Foundry & Machine Co., Phillipsburg, N. J., closed its plant on June 7 to celebrate its fiftieth anniversary. The stockholders and officers of the company, with many invited guests, held a banquet in the large machine shop, which was elaborately decorated for the occasion, and the employes all received

their wages for the day and free transportation to Bellewood Park for themselves and their families, where many amusements were provided for them at the company's expense. About 2,300 went on the excursion, and resolutions were adopted by the employes expressing their appreciation of the generous treatment of the company on this and other occasions.

W. A. Williams, acting district manager of the American Car & Foundry Co., has been appointed district manager in charge of the Madison steel car plant, the St. Louis wood car shops, and the St. Louis steel foundry. He will also have charge of the new steel car plant in St. Louis.

W. A. Bole, vice president of the Westinghouse Machine Co., Pittsburg, and manager of the foundries, sailed for Europe last week on a short vacation.

Geo. Lloyd, formerly foreman of the Fort Hill Bronze Co., Boston, has accepted a position as foreman of the brass foundry of the Lock Regulator Co., Salem, Mass.

Fred Winslow has been made foreman of the Union Iron Foundry, of Lowell, Mass.

Deaths.

Adam Loeffelholz, of Milwaukee, Wis., died on May 19 at the age of 79. Mr. Loeffelholz was born in Germany, and came to Milwaukee in 1856. He was the head of the firm of Loeffelholz & Co., brass founders and finishers.

Fires.

The Leonard Stove & Range Co., Bowling Green, O., was damaged to the extent of $25,000 by fire on May 30, when the entire plant, with the exception of the brick molding room, was burned. A large number of new brass patterns were destroyed.

The pattern shops of the East Buffalo Iron Works, Buffalo, N. Y., burned June 2, with a loss of $12,500.

The foundry building of the Latrobe Foundry & Machine Co., of Latrobe, Pa., of which John F. Gilligan is owner, burned with all its contents June 12, with a loss of $10,000.

The Sanford-Day Iron Works, Knoxville, Tenn., were damaged to the extent of $2,000 by fire May 26.

NEW CONSTRUCTION.

P. J. Donovan and John Regan, Lawrence, Mass., are starting a new foundry, 70 x 90, which will be known as the City Iron Foundry.

Watson & Newell, of Attleboro, Mass., have completed a small addition to their silver foundry.

The Springfield Foundry Co., Springfield, Mass., will erect a foundry 110 x 280 feet, which will be equipped with all modern improvements for the manufacture of high grade gray iron castings. The new structure will cost about $80,000 and will be ready for operation by early fall. The officers of the company are W. F. Calendar, president; David Hale, treasurer, and James Hale, secretary.

The Waltham Foundry Co., of Waltham, Mass., will erect a new building 44 x 80 feet, which will increase the capacity of its foundry one-third.

The Chas. E. Miller Co., recently incorporated to conduct a foundry business, is completing a plant at Twenty-eighth street and First avenue, New York City. It will have about 8,000 feet of floor space, and will employ 75 men at the start.

The Crist Valve Mfg. Co., Chittenango, N. Y., has just erected an iron cupola and will make iron valves in addition to carrying on a general foundry business in the way of light castings.

The Davison-Namack Foundry Co., Ballston Spa, N. Y., has plans completed for a $10,000 foundry which is to be built along the tracks of the Delaware & Hudson railroad. Citizens of the village will furnish the site.

R. Hoe & Co., 504 Grand street, New York City, have taken out a permit for a brick foundry and shop, 148 x 200 feet, to cost $75,000.

The Troy Malleable Iron Works, Troy, N. Y., has let a contract for a new foundry building, 75 x 375 feet. An addition 75 x 135 feet was recently made to the core room.

The Hershey Mfg. Co., Manheim, Pa.,

is planning to increase the size of its foundry. H. W. Stauffer is manager of the plant.

The Penn Steel Castings Co., Chester, Pa., is to erect a foundry of brick construction, 80 x 200 feet.

The Humphrey Mfg. Co., of Towanda, Pa., has let the contract for its new plant at Elkins, W. Va., consisting of foundry, machine shop, pattern shop, etc., to L. E. Parkinson.

The Riley-Harrold Engineering Co., Columbiana, O., will soon begin the construction of a foundry.

The East Liverpool Foundry, Machine & Supply Co., of East Liverpool, O., recently incorporated, is still operating its old plant, but will soon begin the construction of a new foundry and machine shop, for which equipment will be purchased. Geo. A. Anderson is general manager.

The Klotz Machine Co., Sandusky, O., has completed the remodeling of its foundry and the erection of a three-story brick building, 60 x 120 feet, for machine shop and pattern shop purposes. A five-ton traveling crane and considerable new machinery has been installed.

The Steel Foundry Co., Cincinnati, is ready to begin operations by blowing in one 15-ton acid furnace. A 15-ton basic furnace will be started August 1, and work on the completion of the plant will be rushed during the summer.

The Ohio Foundry Co., Cleveland, O., has purchased a tract of eight acres on the Nickel Plate tracks and will construct a steel and brick foundry, 150 x 300 feet.

Plans have been completed for a pattern shop, 60 x 200 feet, to be erected by the Stacey Mfg. Co., Elmwood Place, Cincinnati, O.

The City Brass Foundry Co., Cleveland, O., is enlarging its present plant by the erection of a brass foundry, 60 x 130 feet.

The J. A. Fay & Egan Co., Cincinnati, O., is to erect a new pattern shop on Continental avenue and Augusta street.

Work has been begun on a large addition to the foundry and machine shops of S. J. Gardner, New Albany, Ind., and the building is to be completed within ninety days.

The Kerr-Murray Mfg. Co., Ft. Wayne, Ind., has secured a tract of land near Ft. Wayne and will erect an extensive plant, plans for which have already been completed.

Geo. H. Cappel and Rudolph Haag will soon begin the operation of a foundry, 26 x 60 feet, which is now being built at Plymouth, Ind., by Mrs. Louisa Cappel. The foundry will take care of local jobbing trade only.

The contract for a foundry for the Winona Technical Institute, Indianapolis, Ind., has been let.

The Fox River Iron Co., of Aurora, Ill., recently incorporated by John Love, Joy Love and George Lennington, purchased the plant of the old smelting works between Aurora and North Aurora, and has remodeled and fitted up these works for a large foundry plant. The work is now nearly completed and the company will soon begin operating the plant for general foundry work, making a specialty of small castings. About 60 men will be employed at first.

George H. McKinley, Moline, Ill., has purchased a site on which he will at once erect a foundry for the manufacture of brass and aluminum castings, making a specialty of pattern work. The building will be 36 x 70 feet.

The addition to the foundry of the Eclipse Gas Stove Co., Rockford, Ill., will soon be completed.

The David Bradley Mfg. Co., Bradley, Ill., has begun improvements which will double the size of the present foundry, and will fit up a department for the manufacture of malleable and semi-steel castings and fittings.

The Covell Mfg. Co., 8 South Canal street, Chicago, Ill., is having plans prepared for a foundry to be built at Benton Harbor, Mich., at a cost of $13,000.

The Aetna Foundry & Machine Co., Springfield, Ill., will soon reconstruct the portion of its plant recently destroyed by fire, including the foundry, boiler and engine rooms.

The Rockford Malleable Iron Works has secured a site of 15 acres along the C. B. & Q. railroad at Rockford, Ill., and will soon begin the construction of

its new plant, consisting of a main building, 140 x 460 feet, and a number of other buildings, including a warehouse and office building.

A. F. Bartlett & Co., Saginaw, Mich., builders of Corliss engines and coal mining machinery, are constructing an addition to their foundry which will be operated for custom work.

The Penberthy Injector Co., Detroit, Mich., is soon to begin work on a large addition to its present plant and a separate office building, which will increase its capacity about 50 per cent.

Termaat & Monahan, of Oshkosh, Wis., are erecting a fireproof concrete storehouse for patterns, at a cost of $1,500. They also plan to enlarge their foundry by a thirty-foot extension, to be used for casting the brass used in their engines.

Work has been commenced on a new foundry and machine shop for the R. J. Schwab & Sons Co., Milwaukee, Wis., to replace the old plant which has been torn down. Concrete blocks will be used in its construction, and modern equipment will be installed. The company expects to have the plant completed in three months.

A. H. Welling, Niles, Mich., is erecting a new foundry. The walls of the new plant are being built around the old one, which will not be torn down until the new plant is built up all about it.

Sternad Bros., of Kewaunee, Wis., are erecting buildings at Lena, Wis., for the manufacture of farm machinery. The plant will consist of pattern shop, foundry, machine shop, power house, etc.

The Beaver Dam Malleable Iron Co., Beaver Dam, Wis., which lately increased its capital stock from $100,000 to $200,000, is erecting a building 90 x 300 feet to be used as a foundry, and another of the same size for annealing room, core room, etc. The new plant will be run in connection with the old one, and will soon be in operation with 100 molders.

The Maryland Brass Works, Baltimore, Md., has purchased a large lot adjoining its plant, and is now erecting an addition to its works.

The Clarksville Foundry & Machine Co., Clarksville, Tenn., has nearly completed its new plant, including a foundry 62 x 90 feet and machine shop 50 x 90 feet. The president of the company is Guy R. Johnson, managing director of the Helen furnace, from which it derives its power.

The Livermore Foundry & Machine Co., Memphis, Tenn., is making extensive repairs and installing new machinery, which will largely increase its capacity. L. E. Traylor was recently made general manager.

The Golden Foundry & Machine Co., Columbus, Ga., has purchased a tract of land upon which it plans to erect an addition to its plant.

The Dickson Car Wheel Co., Houston, Texas, is already beginning the erection of a new foundry plant on the site of the one recently destroyed by fire. This will be of reinforced concrete construction, 110 x 500 feet, and the company will spend $100,000 in building and equipping it. Temporary quarters were at once fitted up after the fire, and within a few days the foundry was in active operation.

The J. P. Symons Foundry, Centralia, Wash., recently destroyed by fire, will be rebuilt. A temporary structure will house operations until permanent building plans are decided upon.

The foundry of the Colorado Fuel & Iron Co., at Minnequa, near Pueblo, Colo., will be enlarged by two additional buildings. Most of the material used in their construction will be obtained from the tin plate mill which was erected about two years ago, but has never been used, and is now being torn down.

The Victor Foundry Co., of Victor, Colo., has completed an addition to its plant, and equipment is now being installed.

John T. Hinch is building a pattern shop in Oakland, Cal., at a cost of $2,000.

Work has been started on the new plant of Silver Bros., of Salt Lake City, Utah. Four buildings will be erected, including a foundry and machine shop, at a cost of $25,000, and the work will be completed as quickly as possible.

The A. Merle Co., San Francisco, Cal., is erecting a building to take the place of the plant recently destroyed by fire, and will soon be able to resume business.

The Southwestern Iron Co., Guthrie, Okla., has begun the operation of its new plant, consisting of a foundry 60 x 80 feet and a machine shop 40 x 120 feet. C. H. Martindale is president and general manager.

The El Paso Foundry & Machine Co., El Paso, Texas, has purchased a site of 30 acres and will erect an extensive plant in the near future.

The Timpson Mfg. Co., Timpson, Tex., which was recently organized to manufacture the Reed cotton planter, has decided to add an iron foundry to its plant, catering to the jobbing trade.

Con Ehret is enlarging his foundry in Oklahoma City, O. T. The improvements will cost about $2,000.

The managers of the Bowmansville Foundry, of Bowmansville, Ontario, are planning to enlarge the plant by a three-story addition.

The Northern Iron Works Co., of Winnipeg, Man., has purchased a 25-acre tract of land in Elmwood, near that city, upon which it will shortly begin the construction of an extensive plant.

In order to obtain brass and bronze castings suitable for its high pressure hydraulic work, the Watson-Stillman Co., of New York City, will build its own foundry, which will be equipped with special appliances for making high grade castings for hydraulic work. The plant has been designed by G. K. Hooper, 11 Broadway, New York.

The plant of the Joshua Hendy Machine Works at Bay and Kearney streets, San Francisco, Cal., was entirely destroyed by fire. They will put up extensive works with all modern improvements in foundry, pattern shop and machine shop, and will be in the market for tools and machinery of all kinds.

GENERAL INDUSTRIAL NOTES.

The Massachusetts Brass & Iron Co. has been incorporated with a capital stock of $75,000 to manufacture castings, machinery, pumps, etc. The officers are: President, M. E. McQuire, Boston, Mass.; treasurer, H. Wellington, Brookline, Mass.; clerk, George T. Shannon, Boston, Mass.

W. S. MacIntyre, of Salem, Mass., has purchased the Valley Falls Iron Foundry, Valley Falls, R. I., formerly operated by M. J. Dyer. Mr. MacIntyre also operates two iron foundries in Salem, Mass., and one in Lynn, Mass.

The Union Foundry Co. has been granted a charter in Massachusetts to carry on a general foundry and machine business. The capital stock is $10,000, and the officers are David F. Dillon, president; Emmons Crocker, treasurer, and Rodney Derby, clerk, all of Fitchburg, Mass.

The Richmond Hill Foundry Co. has been incorporated with a capital stock of $12,000 to manufacture steel, iron and metal products, etc. The incorporators are Ernest Haussler, 10 Cherry street, Brooklyn Hills, N. Y.; Thomas Rochester and Peter Belford, Richmond Hill, N. Y.

The Day Foundry Co. has been incorporated to conduct a general foundry business by Reginald F. Day, William Smith, and P. B. McNaughton, Buffalo, N. Y. The capital stock is $20,000.

The Gruson Iron Works, near Chester, Pa., have been purchased by Burnham, Williams & Co., and will hereafter be operated as the Eddystone plant of the Baldwin Locomotive Works. Additions will be made to the foundry buildings, which will make them 900 feet in length, and they will be used for the manufacture of heavy iron castings.

The Valley Forge Foundry Co., Valley Forge, Pa., has been organized with a capital of $5,000 by Ernest Henning, of Philadelphia, William C. Lilly and Edgar S. Waters, Valley Forge.

The Standard Foundry & Steel Castings Co., with principal offices at Pittsburg, Pa., has been incorporated with a capital stock of $50,000 by J. M. B. Hoff, A. E. Pearce, L. F. Cotton, and A. H. Fuller, all of Pittsburg.

The Federal Steel Castings Co., Chester, Pa., has been organized with a capital of $500,000 to take over the plant of the Delaware River Steel Castings Co., which it will extend and operate.

The Norton Emery Wheel Co., of Worcester, Mass., well-known manufacturer of grinding wheels, has changed its name to the Norton Co.,

on account of the fact that all of the Norton grinding wheels are no longer made of emery, but of alundum, an artificial abrasive made in electric furnaces by the Norton Co., at Niagara Falls, N. Y.

The Monarch Coke & Coal Co., Uniontown, Pa., has opened a sales office on the twelfth floor of the Frick building annex, Pittsburg, Pa., and all communications concerning sales, contracts, etc., should be addressed to this office, but the shipping and accounting office will be continued at Uniontown.

The Dayton Pneumatic Tool Co.'s new plant at 435-7 East First street, Dayton, O., has been completed and the equipment has been moved to its new quarters, and additional machinery installed to increase its capacity, which has been greatly enlarged during the past year.

The Shanafelt Mfg. Co., successors to the Canton Fillet Co., of Canton, O., reports that its sales have increased over 300 per cent in the past year. This is a good indication of the present foundry trade conditions.

The Fort Pitt Malleable Iron Co., Pittsburg, Pa., is the name under which the Fort Pitt Malleable & Gray Iron Co. is now operating, as the manufacture of gray iron castings has been discontinued by this company. The company has enlarged its plant at McKees Rocks, Pa., and is building additional annealing ovens to provide a capacity of 1,100 tons a month.

The Reading Steel Castings Co., Reading, Pa., has been incorporated with a capital stock of $125,000 by D. W. Yeckley and W. Conover, of New York, and S. J. Wheeler, of Roselle, N. J. The plant formerly occupied by the Brylgon Steel Casting Co., at Reading, Pa., will be put in shape to manufacture small castings. W. D. Sargent is president and J. Turner Moore vice president and general manager of the company, which has an office at 114 Liberty street, New York.

The Buckeye Sand Co., Pittsburg, Pa., has purchased a large tract of molding sand on the W. & L. E. railroad at Cumberland, O. A branch office has been located in the Majestic Bldg., Detroit, Mich., and placed in charge of Frederick O. Brandt, formerly in the wholesale coal business with Jules G. Hoffman, of that city.

The Kellogg-McCrum-Howell Co., Uniontown, Pa., has been changed to the McCrum-Howell Co., the interest of C. B. Kellogg, of New York, having been purchased by the other two principal stockholders. L. J. McCrum is now president and treasurer; Geo. D. Howell, vice president, and Howard T. Gates, secretary. The company owns a radiator works at Uniontown, Pa., and a boiler factory at Norwich, Conn., and is completing an enameled ware plant at Uniontown.

The J. B. Foote Foundry Co., Fredericktown, O. has been incorporated with a capital of $40,000 by James B. Foote, Herminie E. Foote, L. W. Dennis and W. D. Foote. The company will continue the manufacture of bells and hardware specialties, which has been carried on under the same management for the past five years.

The I. & E. Greenwald Co., of Cincinnati, has increased its capital stock from $200,000 to $500,000, and large extensions to the plant are contemplated.

The Aetna Brass Mfg. Co., Cleveland, O., has been incorporated by Thos. J. Flannagan, Wm. J. McGrath, Margaret McGrath, Anna McGrath and J. E. Leighton. Capital stock, $10,000.

Cain Bros. Foundry & Machine Co., of East Liverpool, O., has been incorporated with a capital stock of $20,000 by John C. Cain, John W. Cain, Thomas F. Cain, Wm. M. Cain and S. A. Cain.

The Standard Foundry Co., Dayton, O., has been incorporated with a capital of $20,000 by Samuel P. Greene, Cornelius Mahoney, George A. High, W. P. Anglemyer and Arthur H. Lockwood. The company will conduct a general foundry business.

The Craig-Reynolds Foundry Co., Dayton, O., is to dispose of its plant located in North Dayton, authority for the sale having been voted by the stockholders. A board of directors has been chosen as follows: H. N. Reynolds and George B.

Smith, of Dayton, and William C. Proctor, Thomas B. Shipley and E. B. Emerson, of Cincinnati.

The Jeffrey Mfg. Co., Columbus, O., has increased its capital stock from $1,000,000 to $6,000,000. Of this, however, only $200,000 will be issued at present.

The Calkins Stove Mfg. Co., Columbus, O., has been incorporated with a capital of $100,000 to manufacture stoves and ranges of all kinds. The incorporators are William R. Calkins, Oscar H. Mithoff, George H. Harkenberg, Alvah A. Faine and William Reed.

The Butler Foundry Co., Hamilton, O., has been incorporated with a capital of $10,000 by Louis A. Flume, Charles C. Friebel, Bernard M. Fuersich, George J. Fuersich and Henry Schuhaus.

The Shelbyville Foundry & Machine Works, Shelbyville, Ind., has been incorporated by S. J. Meyers, Frank E. Irwin and Carey D. John, of Shelbyville, and E. T. Spencer and N. A. Spencer, of Gregory, S. D. The officers are S. J. Meyers, president; E. E. Spencer, vice president; Carey D. John, secretary. Capital stock, $50,000. The company has purchased the foundry and machine shop which has been operated by Meyers & Irwin under the name of the Shelbyville Foundry & Machine Works, and will erect an additional building, 34 x 70 feet, and use the entire plant for the manufacture of gasoline engines.

The Marion Iron & Brass Bed Co., Marion, Ind., has been incorporated with a capital of $150,000 by George C. Harwood, Charles G. Barley and Seneca W. Winder. Work will be started at once on a new plant, which the company expects to have in operation by early fall.

The Eagle Foundry Co., Muncie, Ind., has arranged to occupy a portion of the plant of the Indiana Bridge Co., which will enable it to increase its force. Brass and iron castings are manufactured.

The capital stock of the Gardner Governor Co., Quincy, Ill., has been increased from $100,000 to $150,000. The company recently established a foundry at La Grange, Ill., and has also increased the capacity of its plant at Quincy.

The Geneva Foundry & Supply Co., Geneva, Ill., has engaged James Barr, of Chicago, as superintendent of its new plant, and preparations are now being made for the installation of complete equipment for beginning operations.

The Beloit Foundry Co., Beloit, Wis., has been incorporated with a capital of $5,000 by E. R. Branigan, John Gosline, Albert Balderson and Paul Halverson.

The Aluminum Foundry Co., of Manitowoc, Wis., has been incorporated with a capital stock of $15,000 by Conrad Werra, Henry Stahl and Julia Werra. The company has been operating a plant for the manufacture of aluminum castings for several years.

The Wessinger Co. has been incorporated at Duluth, Minn., with a capital of $50,000, to operate a machine shop and foundry. The incorporators are H. J. Wessinger, W. E. Wessinger and A. C. Gillette, Duluth, Minn.

The property of the Battle Creek Iron Works Co. has been sold to W. G. Hay, of Battle Creek, Mich., representing some of the bondholders, for $31,140.

The H. Ruesch Machine Co., No. 22 Green street, Newark, N. J., toolmaker, machinist, founder and mechanical and electrical engineer, has been incorporated with a capital stock of $100,000. The incorporators are Henry J. Ruesch, Herman F. Behrendt and Albertina J. Ruesch, all of Newark, N. J.

J. H. Gautier & Co., Jersey City, N. J., whose works were damaged by fire a few weeks ago, announce that they are again manufacturing crucibles and ready to fill orders.

The Ocala Iron Works, Ocala, Fla., has been organized with a capital of $100,000 to take over, enlarge and operate the Ocala Foundry & Machine Works.

The Cook-Lewis Foundry Co., of Greensboro, N. C., has been organized with a capital of $25,000 to take over the plant of W. B. Cook & Co., of that city. The incorporators are W. B. Cook and A. R. Lewis.

The Mountain City Foundry & Machine Co., Greenville, S. C., has purchased the plant of the Palmetto Iron Works, of the same city, which will be consolidated with it.

The Motor Components Co., Des Moines, Ia., has lately installed equipment for a brass foundry.

W. H. Pence has opened a shop for the manufacture of wood and metal patterns at Fairfield, Ia., under the name of the Eagle Pattern Works.

J. B. Baxter & Son are starting a new foundry in Hutchinson, Kan.

Mr. Boddy, who has taken over the Marysville Machine Shop & Foundry, of Marysville, Wash., will change its name to the Marysville Iron Works.

Joe Schram has purchased the Rocky Ford Brass Foundry, Rocky Ford, Colo., and will operate it as a general jobbing foundry.

The Stalcup Mfg. Co., Unionville, Mo., has lately started a foundry for custom work.

The Kraushaar Brass Mfg. Co., of St. Louis, Mo., recently increased its capital stock from $50,000 to $150,000.

The Jasper County Foundry, of Carterville, Mo., has bought the J. H. McKenna plant at Joplin, which has been idle for six months, and is now operating both plants at full capacity. Edward McDonald is manager of both plants.

The Port Angeles Stove Co., Olympia, Wash., has been incorporated with a capital of $500,000 by Arthur J. Burroughs, Thomas Heath and C. T. Gloss.

The Rogers Conklin Mfg. Co., Joplin, Mo., has gone out of the supply business and will confine itself in future to strictly foundry work.

The Central Foundry Co., Webb City, Mo., will greatly enlarge the capacity of its foundry, which is devoted to the manufacture of ore crushing machinery.

The Central Foundry, Ltd., head office, Toronto, capital $200,000, provisional directors, Henry L. Bowers, Hiram T. Bush and Robert C. Donald, has been incorporated.

Mr. F. E. Lonas, of 80 Wall street, New York, has taken over the molding machine business heretofore conducted in Chicago by the Maywood Foundry & Machine Co., and all business will be carried on hereafter by Mr. Lonas at the above address under the old name.

The American Valve Co., Coxsackie, N. Y., which recently incorporated under New York laws, has let the contract for a new iron foundry which will cost about $12,000 and will be ready for occupancy Aug. 1.

The United States Cast Iron Pipe & Foundry Co. expects to have the additions now under way at its Chattanooga works in operation by August. The buildings are of brick and steel construction and will add about two-thirds to the present output of the works, with a specialty of large size pipe. Equipment has been purchased.

The Central Foundry Co., Webb City, Mo., has been incorporated with $35,000 capitalization by J. H. Wathmey, Adolph Steel and H. W. Currey.

The Charlotte Pipe & Fdy. Co., Charlotte, N. C., is erecting a building 100 x 150 feet to replace that recently destroyed by fire.

The new plant of the Utica Pipe Foundry Co., Utica, N. Y., will probably be ready for operation by September, with a capacity of 200 tons of pipe per day. All the contracts have been let and the foundation work is completed. The buildings will be of iron and steel throughout. The main foundry building is 115 x 240 feet, with two cleaning and testing houses each 40 x 220 feet, a boiler house 40 x 75 feet and an engine and generator house 40 x 75 feet. The main foundry building will be equipped with traveling bridge and jib cranes and electric power will be used throughout.

The Pittsburg Valve & Fittings Co. is preparing to erect a large malleable iron foundry at its works at Barberton, O. The new building will measure about 125 x 450 feet.

Contracts have been let and the work of construction has already begun on extensive improvements at the works of the Union Malleable Iron Co., East Moline, Ill. These include an addition to the foundry 152 x 234 feet, an addition to the annealing house 102 x 133 feet and a new core building 57 x 220. Three 15-ton furnaces and eight 25-ton annealing ovens will be installed. The company expects to increase its power plant by adding two 150-horsepower water tube boilers and a 300 K. W. direct connected alternating generator. These improvements, it is expected, will increase the capacity of the works about 60 per cent.

WE **SOLD** OVER

40,000

BARRELS FLOUR

in the past twelve months

Some one must be satisfied with the flour which they are getting, as well as the treatment accorded them, else we could not have done this amount of business.

We are pleased to announce that we are now in shape to do double the amount of the above business in the future, as we have largely increased the capacity of our plant.

The Piqua Flour Co.

PIQUA, OHIO, U. S. A.

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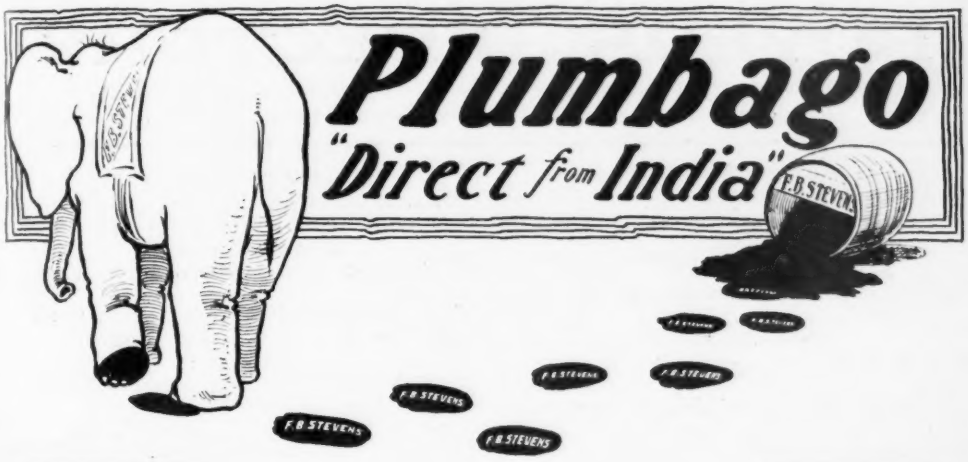

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Stevens' Genuine East India Plumbago or **Imported Ceylon Lead** has already made its favorable impression and the careful foundryman recognizes its merit. It saves in three ways.

In cost of cleaning the casting; in less quantity used, and in producing better castings. The latter effect saves loss of customers.

Stevens' R. I. Core Wash is making the same good impression. It is used on large and small cores, and as a Dry Sand or Wet Blacking. You will find its "foot-prints" in some of the largest and best managed foundries. Its use means pocket-book satisfaction. More information if you will write me.

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Corner Larned and Third Sts.

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Isabella Ave. & M. C. R. R.

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Advertisers' names are inserted under this heading at the rate of four classifications to each page advertisement carried regularly.

Abrasive Materials:
Carborundum Company, Niagara Falls.
Norton Emery Wheel Co., Worcester.

Accountants.
Gunn, Richards & Co., New York.
Library Bureau, Systematizing Dept., Boston.

Air Compressors:
American Air Compressor Works, New York.
Chicago Pneumatic Tool Co., Chicago.
Curtis & Co. Mfg. Co., St. Louis.
Ingersoll-Rand Co., New York.
Norwalk Iron Works Co., So. Norwalk, Conn.

Alloys:
Blackwell Sons & Co., Geo., Ltd., Liverpool, Eng.
New Era Mfg. Co., Kalamazoo, Mich.
Phosphor Bronze Smelting Co., Ltd., Philadelphia.

Analysis—Mechanical:
Keep, W. J., Detroit.

Analysis—Chemical:
Metallurgical Laboratory, Pittsburg.

Anchors:
Lindsay & Co., W. W., Philadelphia.

Babbitt Metal:
Ajax Metal Co., Birmingham, Ala.

Barrels—Steel:
Kilbourne & Jacobs Mfg. Co., Columbus.

Blowers:
American Blower Co., Detroit.
Connersville Blower Co., Connersville, Ind.
Cornell Co., J. B. & J. M., New York.
Monarch Engineering & Mfg. Co., Baltimore.
Roots Company, P. H. & F. M., Connersville, Ind.
Sturtevant Co., B. F., Boston.

Blowers—Positive Pressure:
Connersville Blower Co., Connersville, Ind.
Piqua Foundry & Mch. Co., Piqua, O.
Roots Company, P. H. & F. M., Connersville, Ind.
Sturtevant Co., B. F., Boston.

Brushes:
Osborn Mfg. Co., Cleveland.

Buildings (Struct. Steel):
Lindsay & Co., W. W., Philadelphia.

Burners (Oil):
Monarch Engineering & Mfg. Co., Baltimore.

Carbonese:
Midvale Mining & Mfg. Co., E. St. Louis, Ill.

Castings (Steel):
Otis Steel Co., Ltd., Cleveland.

Cement (Furnace):
Dixon Crucible Co., Jos., Jersey City.
Gautier & Co., J. H., Jersey City.

Cement (Metallic):
Clark Cast Steel Cement Co., Shelton, Conn.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

Chaplets:
Burdick & Son, Albany.
Fanner Mfg. Co., Cleveland.
Lindsay & Co., W. W., Philadelphia.
U. S. Chaplet Co., New York.

Coke:
Rogers, Brown & Co., Cincinnati.

Cores:
Brown Specialty Machry. Co., Chicago.

Core Binders:
Holland Linseed Oil Co., Chicago.
Millers' Products Co., Chicago.
Mills Oil Co., C. E., Syracuse.
National Jeloluse Co., New York.
Robeson Process Co., Camden, N. J.
Sterling Oil Co., Emlenton, Pa.

Core Machines:
Brown Specialty Machry. Co., Chicago.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Jones & Atwood, Stourbridge, Eng.
Kent Mfg. Co., Kent, O.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

Core Tapering Machines:
Brown Specialty-Machinery Co., Chicago.

Core Ovens:
Atlas Car & Mfg. Co., Cleveland.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Millett Core Oven Co., Brightwood, Mass.
Paxson Co., J. W., Philadelphia.
Pangborn Thos. W. Co., New York.
Smith Foundry Supply Co., J. D., Cleveland.

Core Oven Recording Thermometer:
Bristol Co., Waterbury.

Cost Keeping Systems.
Gunn, Richards & Co., New York.
Library Bureau, Systematizing Dept., Boston.

Cranes:
Case Mfg. Co., Columbus, O.
Curtis & Co. Mfg. Co., St. Louis, Ill.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia.
Niles-Bement Pond Co., New York.
Northern Engrng. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Ridgway & Son, Craig, Coatesville, Pa.
Sellers & Co., William, Inc., Philadelphia.
Whiting Foundry & Equipment Co., Harvey, Ill.

Continued on page 176

STEVENS SILVER FINISH

STEVENS SILVER FINISH

¶ The success of the stove making fraternity throughout this great and glorious country may be due in part to the way they dress up things with nickel plated trimmings.

¶ The beauty of any nickel plate is greatly enhanced by the use of STEVENS' SILVER FINISH. Wherever a brilliant finish is required nothing else is as good---especially where there are deep backgrounds liable to be filled, particles so left are easily washed out.

¶ It gives pocket-book satisfaction. I manufacture a complete line of Polishing and Plating Compositions. Samples sent without charge, and by express prepaid.

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Frederic B. Stevens

Corner Larned and Third Streets

DETROIT, MICH.

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Moussette, O. J., Brooklyn.

Crucibles:
Dixon Crucible Co., Jos., Jersey City.
Fair, Taylor & Co., San Francisco.
Gautier & Co., J. H., Jersey City.
McCullough-Dalzell Crucible Co., Pittsburg.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson Co., J. W., Philadelphia.
Ross-Tacony Crucible Co., Philadelphia.
Seidel, R. B., Inc., Philadelphia, Pa.
Taylor, Robt. J., Inc., Philadelphia.
Waterbury Crucible Co., Waterbury.

Cupolas:
Byram & Co., Detroit.
Gilmour, J., New York.
McCormick Co., J. S., Pittsburg.
Northern Engnrng Works, Detroit.
Paxson Co., J. W., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.

Cupola Linings:
McCormick Co., J. S., Pittsburg.
Paxson Co., J. W., Philadelphia.

Curbing (Foundry):
United States Steel Piling Co., Chicago.

Elevators:
Curtis & Co. Mfg. Co., St. Louis.
Ridgway & Son, Craig, Coatesville, Pa.

Engines (Gas):
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

Engines (Steam):
American Blower Co., Detroit.
Sturtevant Co., B. F., Boston.

Engineers (Foundry, Mech., Elec., &c.):
Dodge & Day, Philadelphia.
Hoermann, A. E., New York.
Hooper, Geo. K., New York City.
Lindsay & Co., W. W., Philadelphia.

Facings:
Buffalo Foundry Supply Co., Buffalo.
Cohutta Talc Co., Dalton, Ga.
Dixon Crucible Co., Jos., Jersey City.
Hill & Griffith Co., Cincinnati.
R. MacKellar's Sons Co., Peekskill, N. Y.
McCormick Co., J. S., Pittsburg.
Obermayer Co., S., Cincinnati.
Paxson Co., J. W., Philadelphia.
Smith Foundry Supply Co., J. D., Cleveland.
Stephens & Co., Kidwelly, Eng.
Stevens, F. B., Detroit.
Western Foundry Supply Co., E. St. Louis, Ill.

Fans:
American Blower Co., Detroit.

Ferro-Manganese:
Kendall & Flick, Washington, D. C.
Rogers, Brown & Co., Cincinnati.

Ferro-Silicon:
Roessler & Hasslacher Chemical Co., New York.
Rogers, Brown & Co., Cincinnati.

Fillers (Metallic):
Clark Cast Steel Cement Co., Shelton, Conn.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

Fillets:
Brodin, John A.,
Cleveland Fillet Co., Cleveland, O.

Fire Brick:
Gautier & Co., J. H., Jersey City.
Maurer & Son, Henry, New York.

Fire Sand:
Carborundum Co., Niagara Falls, N. Y.

Flasks:
Adams Co., Dubuque, Ia.
Barnett Fdy. Co., Oscar, Newark.
Brass Founders' Supply Co., Newark.

Flasks (Snap):
Adams Co., Dubuque, Ia.
Diamond Clamp & Flask Co., Richmond, Ind.
Obermayer Co., S., Cincinnati.
Smith & Caffrey Co., Syracuse, N. Y.

Flour:
Millers' Products Co., Chicago.
Piqua Flour Co., Piqua, O.

Foundry Equipment (Iron & Brass):
Barnett Fdy. Co., Oscar, Newark.
Etting, Edward J., Philadelphia.
Obermayer Co., S., Cincinnati.
Pangborn, Thos. W. Co., New York.
Sly, W. W. Mfg. Co., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.

Foundry Supplies:
Buffalo Fdy. Supply Co., Buffalo.
Caufman, S. H., Chester, Pa.
Fair, Taylor & Co., San Francisco.
Hill & Griffith Co., Cincinnati.
McCormick Co., J. S., Pittsburg.
Obermayer Co., S., Cincinnati.
Osborn Mfg. Co., Cleveland.
Pangborn, Thos. W. Co., New York.
Paxson Co., J. W., Philadelphia.
Smith Foundry Supply Co., J. D., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.

Furnaces (Melting):
Barnett Foundry Co., Oscar, Newark, N. J.
Hawley Down Draft Furnace Co., Chicago.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson Co., J. W., Philadelphia.
Rockwell Engineering Co., New York.

Graphite:
U. S. Graphite Co., Philadelphia.

Grinding Machinery:
Adams Co., Dubuque, Ia.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
National Corundum Wheel Co., Buffalo.
Norton Emery Wheel Co., Worcester.
Ransom Mfg. Co., Oshkosh, Wis.

Continued on page 178

The Cost of It

The expense of a modern system of cost-keeping need be no greater than a crude, antiquated and inefficient way of keeping accounts.

Such a system is accurate, quick and in ample detail, and it gives the detailed costs of every part of the work while the business is fresh—when it is most valuable as a basis of comparison.

We have studied cost-keeping very carefully and have installed systems which meet these requirements in many well-known foundries.

Will you accord us an interview?

GUNN, RICHARDS & COMPANY

Production Engineers and Public Accountants.....

43 WALL STREET, 43 EXCHANGE PLACE, NEW YORK

50 CONGRESS STREET, BOSTON

224 ST. JAMES STREET, MONTREAL

Grinding Wheels:

National Corundum Wheel Co., Buffalo.
Norton Emery Wheel Co., Worcester.
Pike Mfg. Co., Pike, N. H.
Vitrified Wheel Co., Westfield, Mass.

Grinding Pans:

Crossley Mfg. Co., Trenton, N. J

Hammers (Pneumatic Chipping):

Ingersoll-Rand Co., New York.

Heating & Ventilating Apparatus:

American Blower Co., Detroit.
Sturtevant Co., B. F., Boston.

Hoists:

Chisholm & Moore Mfg. Co., Cleveland.
Curtis & Co., Mfg. Co., St. Louis.
General Pneumatic Tool Co., Montour Falls. N. Y.
Harrington Son & Co., Edwin, Philadelphia.
Niles-Bement-Pond Co., New York.
Northern Engrg. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Sellers & Co., Inc., William, Philadelphia.
Whiting Fdy. Equipment Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York.

Hoists (Pneumatic):

Ridgway & Son, Craig, Coatesville, Pa.

Hydrofluoric Acid:

Dempwolf & Sons, E. A., York, Pa.
General Chemical Co., Philadelphia.

Industrial Ry. Equipment:

Atlas Car & Mfg. Co., Cleveland.
The Gregg Company, Ltd., Newburg, N. Y.
Wiener & Co., Ernst, New York.

Iron Ore:

Rogers, Brown & Co., Cincinnati.

Lacquers:

New Era Lustre Co., New Haven.

Ladles:

Northern Engrg. Works, Detroit.

Lights (Portable):

Wells Light Mfg. Co., New York.

Magnesium Metal:

Leavitt, C. W. & Co., New York.

Molding Machines:

Adams Co., Dubuque, Ia.
Arcade Manufacturing Co., Freeport, Ill.
Berkshire Mfg. Co., Cleveland.
Herman Pneumatic Machine Co., Zelienople, Pa.
McPhail Molding Machine Co., Davenport, Ia.
Manning, Maxwell & Moore, New York.
Maywood Foundry & Machine Co., New York.
Mumford Co., E. H., Philadelphia.
Paxson Co., J. W., Philadelphia.
Pridmore, Henry E., Chicago.
Tabor Mfg. Co., Philadelphia.
Turner Machine Co., Philadelphia.

Oil (Burn-ease):

New Era Lustre Co., New Haven.

Oil (Linseed):

Holland Linseed Oil Co., Chicago.

Packing (Rubber Sheet):

Smooth-On Mfg. Co., Jersey City.

Parting Materials:

Foundy Specialty Co., Cincinnati.
Imperial Fluxing Co., Marion, Ky.
Partamol Co., New York.

Patterns (Metal & Wood):

Brodin, John A., Chicago.
Herman Pneumatic Machine Co., Zelienople, Pa.

Pattern Shop Equipment:

Fox Machine Co., Grand Rapids, Mich.

Phosphorizers:

McCullough-Dalzell Crucible Co., Pittsburg.

Phosphor Tin:

Crescent Phosphorized Metal Co., Philadelphia.
Lang, R. F., New York.
New Era Mfg. Co., Kalamazoo.

Pig Iron:

Addy & Co., Mathew, Cincinnati.
Baird & West, Detroit.
Bartlett & Co., N. S., Boston.
Cherry Valley Iron Co., Pittsburg.
Columbus Iron & Steel Co., Columbus.
Dalton, Nash & Co., New York.
De Camp Bros. & Yule, St. Louis.
Dimmick & Co., J. K., Buffalo.
Domhoff & Joyce Co., Cincinnati.
Elliott, Debevoise & Anderson, New York.
Field Sales Agency, Robert, Cincinnati.
Goodrich & Co., F. A., Detroit.
Hillman & Son, J. H., Pittsburg.
McKeefrey & Co., Leetonia, O.
Mohr, J. J., Philadelphia.
Pickands, Brown & Co., Chicago.
Pickands, Mather & Co., Cleveland.
Pilling & Crane, Philadelphia.
Republic Iron & Steel Co., Chicago & Birmingham.
Rogers, Brown & Co., Cincinnati.
Shepard, Chas. G., Buffalo.
Stevens, F. B., Detroit.
Thomas Furnace Co., Milwaukee.
Walter-Wallingford & Co., Cincinnati & Pittsburg.

Plumbago:

Dixon Crucible Co., Jos., Jersey City.
Gautier & Co., J. H., Jersey City.
Hill & Griffith Co., Cincinnati.
McCullough-Dalzell Crucible Co., Pittsburg.
Obermayer Co., S., Cincinnati.
Pettinos Bros., Bethlehem, Pa.
Ross-Tacony Crucible Co., Philadelphia.
Stevens, F. B., Detroit.

Polishers' & Platers' Supplies:

Stevens, F. B., Detroit.

Continued on page 180.

Production accounting on a sane basis.

Mr. Ellsworth M. Taylor, whose articles on foundry costs were read at both the 1905 and 1906 conventions of the American Foundrymen's Association, is on the staff of our Systematizing Department.

Foundries which have been deterred from revising their cost accounting by the prospect of long drawn-out examinations and experiments on a fee basis will do well to get particulars of our methods.

Preliminary consultation with us creates no obligation. At this consultation we give you approximate information as to the number of days our service will cover.

It must be an unusually large foundry, or one whose production is along very complicated lines in which we cannot finish our work in a few days' time.

Correspondence solicited.

SYSTEMATIZING DEPARTMENT

Library Bureau

530 Atlantic avenue, Boston, Mass.

Polishing Belts:
Gilmer, L. H. & Co., Philadelphia.

Riddles:
Adams Co., Dubuque, Ia.
U. S. Chaplet Co., New York.

Sand:
Albany and North River Molding Sand Co., Albany, N. Y.
Buffalo Fdy. Supply Co., Buffalo.
Dresden Sand Co., Dresden, O.
Paxson Co., J. W., Philadelphia.
Pangborn, Thos. W., New York.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit.

Sand Blast Machinery:
Drucklieb, C., New York.
Pangborn, Thos. W. Co., New York.
Tilghman-Brooksbank Sand Blast Co., Philadelphia.

Sand Mixing Machinery:
Dempwolf & Sons, A. E., York, Pa.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Pangborn, Thos. W. Co., New York.
Sellers & Co., Inc., William, Philadelphia.
Standard Sand & Machine Co., Cleveland.

Sand Sifters:
Deane Steam Pump Co., Holyoke, Mass.
Hanna Engrg. Works, Chicago.
Herman & Son, Chas., Sharpsburg, Pa.
Standard Sand & Machine Co., Cleveland

Saws (Cold Cutting):
Tabor Mfg. Co., Philadelphia.

Seacoal:
Hill & Griffith Co., Cincinnati.
Obermayer Co., S., Cincinnati.
Paxson Co., J. W., Philadelphia.

Separators (Magnetic):
Dings Electro Magnetic Sep. Co., Milwaukee.
Elm City Engineering Co., New Haven.
Pangborn, Thos. W. Co., New York.

Shafting (Flexible):
Stow Mfg. Co., Binghamton, N. Y.

Shoes (Molders' Fireproof):
Brandau, Adam, Detroit.

Shop Equipment:
Mfg. Equipment & Engineering Co., East Boston, Mass.

Shovels:
Stevens, F. B., Detroit.

Silica Wash:
Buffalo Fdy. Supply Co., Buffalo.

Sprue Cutters:
Barnett Fdy. Co., Oscar, Newark.
Shuster Co., F. B., New Haven.

Stoppers:
McCullough-Dalzell Crucible Co., Pittsburg.
Ross-Tacony Crucible Co., Philadelphia.
Taylor, Robert J., Inc., Philadelphia.

Stove Trimmings:
Burdick & Son, Albany, N. Y.
Fanner Mfg. Co., Cleveland.

Testing Machines:
Keep, W. J., Detroit.

Thermit Process:
Goldschmidt Thermit Co., New York.

Tools (Molders'):
Dobson, William, Canastota, N. Y.
Obermayer Co., S., Cincinnati.
Smith Foundry Supply Co., J. D., Cleveland.

Tools (Pneumatic):
Dayton Pneumatic Tool Co., Dayton.
Ingersoll-Rand Co., New York.

Torches:
Wells Light Mfg. Co., New York.

Tramrail Systems:
Randall & Co., R. T., Philadelphia.

Tumbling Mills:
Adams Co., Dubuque, Ia.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Gilmour, J., New York.
Sly, W. W. Mfg. Co., Cleveland.

Wax Wire:
Field, Alfred & Co., New York City.

Wire Straighteners:
Shuster Co., F. B., New Haven.
Blake Mfg. Co., Geo. F., New York City.

The Foundrymen's Primer

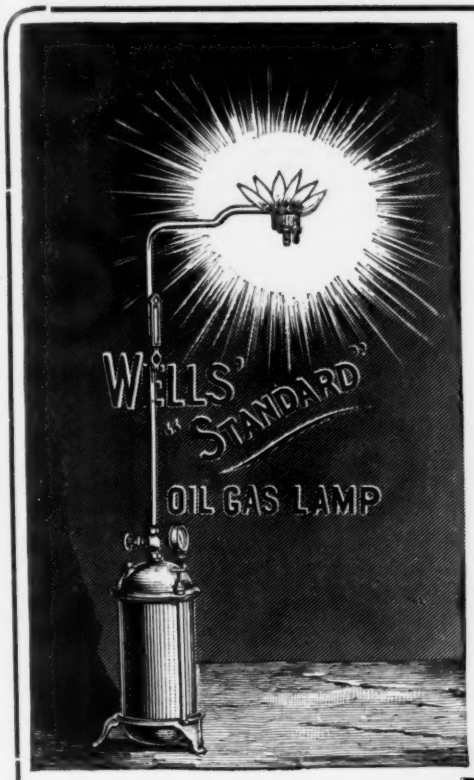
BY WALTER WANGELIN.

Price $1.00

In this little book a practical man, who has had many years' experience as a foundry chemist, describes the different classes of iron and tells how to mix metal, to figure analyses, etc. It is an exceedingly useful little book of 64 pages, bound in paper.

For sale by

The Foundry
CLEVELAND



THE WELLS STANDARD OIL GAS LAMP

FOR

FOUNDRY

USE IS UNSURPASSED

WHERE A SMALL

PORTABLE LIGHT

IS REQUIRED

200 C. P. FROM KEROSENE OIL

CIRCULARS AND DISCOUNTS
BY RETURN MAIL

ALL ORDERS PROMPTLY FILLED BY

THE
WELLS LIGHT
M'F'G CO.
44-48 WASHINGTON STREET
NEW YORK

UNDISPLAYED ADVERTISEMENTS

WANTED and FOR SALE

Undisplayed advertisements will be inserted under this head at 40 cents per line each insertion.

BLOWER BARGAINS.
Roots Second-Hand Blowers, bought, sold or exchanged for new ones. Address,
H. M. PAPWORTH,
120-122 Liberty Street, New York City.

FLUOR SPAR.—Lump and Gravel. Special Qualities. Delivered Eastern Ports. Enquiries solicited. DRABBLE BROS., Mineral Merchants, Matlock, England.

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address GEO. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or agents Penna. Salt Mfg. Co., Pittsburg, Pa.

FLUOR SPAR for foundry use. In barrels of 500 pounds at $5.00 a barrel. Lump gravel or ground fluor spar in bulk or barrels. Highest grades mined. We sell by carload, ton or barrel. Samples on application or any information as to its use. George P. Roberts & Co., Marion, Ky.

FOR SALE:—Well equipped foundry and machine shops in mining district of 30,000 inhabitants. Owner wishes to retire. Address Box 545, THE FOUNDRY, Cleveland.

FOR SALE cheap.—One No. 2½ Whiting Copola and one No. 3 Roots Blower, used only a short while. Or will exchange for larger outfit. Address American Saw Mill Machinery Co., Hackettstown, N. J.

FOR SALE.—Large foundry located in Ohio. For full information address Box 669, THE FOUNDRY, Cleveland, Ohio.

$7,500 will buy foundry and machine shop with 4 1-3 acres of land. Business steadily increasing. Work plentiful year around. Call or write for further particulars to Mobley Bros., Waynesboro, Ga.

FOR SALE.—2 Colliau cupolas, capacity 5 to 7 tons of melted iron per hour. First class condition. Address Studebaker Bros. Mfg. Co., South Bend, Ind.

WANTED.—Traveling crane for space 38 ft. x 75 ft. Address Box 694, THE FOUNDRY, Cleveland, O.

FOR SALE.—Well equipped Foundry and Machine shop, 100 miles from Chicago, in Illinois city of 17,000. This shop is full of work for six months, melting 4 to 5 tons daily. Address Box 700, THE FOUNDRY, Cleveland, O.

FOR SALE.—A number of International Time Recording Clocks and Racks; good condition, almost new. Address, Room No. 1610, First National Bank Bldg., Chicago, Ill.

FOR SALE.—A first-class modern malleable iron foundry with full equipment. All buildings and machinery in the best condition and ready for operation. Foundry has a large capacity and is ideally located at Columbus, Ohio. Has always enjoyed a flourishing business, but must be sold at once, owing to a change in a future business of present owner. For full particulars address inquiry to Room No. 608, Union National Bank Bldg., Columbus, Ohio.

FOR SALE.—Controlling interest in foundry and machine shop in thriving city of Middle West. Only foundry in neighborhood. Minority partners are practical foundrymen and willing to retain interest. Owner has business elsewhere requiring attention. $5,000 cash required. Address Box 162, Mt. Carmel, Ill.

STEEL FOUNDRY located on trunk line near New York. New plant with latest improvements. Open-hearth furnace, gas producer, core ovens, electric cranes, pneumatic chippers, industrial tracks, railroad sidings, etc. Location unsurpassed for labor supply, sales market, transportation, etc. This is a bargain for a quick buyer. Address A. A. Wigand, 293 Lafayette Ave., Passaic, N. J.

FOR SALE.—Bronze and brass foundry in a growing city of 50,000 people, in the center of a large coal field. Established twenty years. Foundry 30 x 60, smelting room 20 x 25, with four furnaces. Reason for selling poor health. Address Box 692, THE FOUNDRY, Cleveland, O.

A BUSINESS OPPORTUNITY of exceptional value. A manufacturing proposition in the Birmingham, Ala., district requiring additional working capital of $15,000 or $20,000. Address Box 693, THE FOUNDRY, Cleveland, O.

A company in Chicago, who has a small well equipped grey iron foundry, desires to rent building and plant. Light and power furnished. Owners can purchase 3 to 4 tons of castings daily. Good opportunity for those desiring to go into this business. For full particulars address Box 699, THE FOUNDRY, Cleveland, O.

HELP WANTED.

Undisplayed advertisements will be inserted under this head at 25 cents per line each insertion.

WANTED.—A superintendent for a plant employing 500 men, manufacturing steam engines, saw mills, and wood working machinery. Must have a thorough technical education, as well as a practical knowledge of the business, including the foundry and modern molding machine practice. Also first class foundry superintendent. Address, Box 660, THE FOUNDRY, Cleveland, O.

WANTED.— Two first-class machine moulders to use stripping plate machines for making light and medium weight castings. Address DeLoach Mill Mfg. Co., Atlanta, Ga.

WANTED.—Foreman for pattern shop. Must be able to take charge of wood and metal pattern departments. None but a high class man wanted. Address, stating salary wanted and give experience with references in confidence, Box 661, THE FOUNDRY, Cleveland, O.

WANTED.—Foreman to take charge of jobbing foundry melting about ten tons daily. Part interest in paying business for the right man. Address Box 686, THE FOUNDRY, Cleveland, O.

WANTED.—Assistant foreman for foundry in the Pacific Northwest. Must be competent, up-to-date and capable of handling men. Light and heavy work. Young married man preferred. Fine opportunity for the right man. Address Box 685, THE FOUNDRY, Cleveland, O.

CONTINUED ON PAGE 184

BURNEASE OIL

We challenge the world to produce a better remedy for burns or scalds. Ask any of the following representative foundries.

WE HAVE PLENTY OF TESTIMONIALS LIKE THESE

Montreal, Sept. 9, 1905.
Messrs. The New Era Lustre Co., New Haven, Conn., U. S. A.
Gentlemen.—In reply to your favor of the 7th inst. we beg to say that we constantly keep a supply of the "Burnease oil" in our foundry. We have proved it to be very beneficial in severe burns, causing them to heal up quickly and preventing blisters from forming.
Yours truly,
Warden, King & Son, Ltd.

Chicago, Sept. 11, 1905.
New Era Lustre Company, New Haven, Conn.
Gentlemen.—Replying to yours of the 7th inst., will say that our company is averse to the giving of testimonials. We would be glad, however, to have you refer any prospective customers to us and we will be pleased to answer them promptly.
Yours truly,
International Harvester Company,
W. O. Jones,
General Manager Purchasing Dept.

Hopedale, Mass., Sept. 5, 1905.
The New Era Lustre Co., New Haven Conn.
Gentlemen.—Your favor of the 2nd is received. We have had excellent results from the use of Burnease Oil and we should say it was a very desirable article to have on hand in case of accident.
Yours truly,
The Draper Company,
E. D. Bancroft,
Purchasing Agent.

Flemington, N. J., Oct. 11, 1905.
New Era Lustre Co., New Haven, Conn.
Gentlemen.—Replying to your favor of Oct. 6, beg to say that we still have some "Burnease Oil" on hand. We have only had occasion to use it a few times, but in cases where tried seemed to work very well.
Yours truly,
Foran Fdry. & Mfg. Co.

Burnham, Pa., Sept. 21, 1905.
New Era Lustre Co., New Haven, Conn.
Gentlemen.—Replying to your letter of September 2nd, would say that we have been using the Burnease Oil, and enclose you our formal order today for five gallons more.
Yours very truly,
The Standard Steel Works.

Newton, Iowa, Sept. 6, 1905.
New Era Lustre Co., New Haven, Conn.
Gentlemen.—Answering your letter of the 2nd inst., inquiring as to our experience with Burnease Oil, will say that we have used the same for the past year or two, and have found it to be all you claim for it. It has fully met our expectations as an efficient and instantaneous remedy for burns in all the accidents of that nature that have occurred in our foundry during the time we have used it. If the use of our name will assist you in furthering the sale of this product, you are at liberty to use it.
Yours truly,
Parsons Band Cutter & Self Feeder Co.

Louisville, Ky., Sept. 12, 1905.
The New Era Lustre Co., New Haven, Conn.
Gentlemen.—Answering yours of the 8th inst., we have had a very few accidents requiring the use of "Burnease" Oil recently. We have plenty of it on hand for some time. Our superintendent tells us that it has been of good service when we have used it.
Yours truly,
B. F. Avery & Sons.

Cincinnati, O., Sept. 16, 1905.
The New Era Lustre Co., New Haven, Conn.
Gentlemen.—In compliance with yours of Sept. 7th:—Burnease Oil has been used in our foundry for some time with very good results and we gladly recommend it. It certainly is an article of merit.
Yours very respectfully,
Wm. Powell Co.

Burnease Oil sold in gallon and barrel quantities
Manufactured exclusively by

NEW ERA LUSTRE COMPANY

91 Water Street
Write for printed matter. **NEW HAVEN, CONN.**

WANTED.—Foundry foreman for Southern shop. State experience fully and salary expected. Address Box 698, THE FOUNDRY, Cleveland, O.

A foreman wanted for a jobbing brass and aluminum foundry. One thoroughly acquainted with modern foundry practice including the mixing of metals under analysis, also accustomed to the handling of men. The foundry is situated within three miles of the City Hall of New York City, and employs about twenty molders. In answering enclose copy of references, state experience, where now employed and salary expected. All correspondence held in strictest confidence. Address Box 696, THE FOUNDRY, Cleveland, O.

WANTED.—A foreman or superintendent for foundry employing from 50 to 60 molders doing general jobbing and building work. Must be able to estimate costs accurately on dry and green sand castings up to 20 tons in weight. New foundry, modern equipment—a good opportunity for a man who knows how to make a foundry profitable. Applications will be considered confidential and must contain full information as to present employment, age, experience, salary wanted, etc. Address Box 697, THE FOUNDRY, Cleveland, Ohio.

WANTED.—Foundry foreman in live southern seaport town, 40,000 population. Must be first-class all round founder; one who would invest small amount in business preferred. Good pay. Fine chance for right man. Address Box 681, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN WANTED.—One who has had experience on agricultural implement or light work. Must be capable of handling seventy molders on benches and molding machines. Good position for right man. State fully, age, experience and salary expected. Address Box 680, THE FOUNDRY, Cleveland, Ohio.

WANTED.—Thoroughly competent man of good executive ability to serve as foreman of a general jobbing foundry, making gray iron, brass and bronze castings. Address, giving references and stating experience and lowest wages, Box 682, THE FOUNDRY, Cleveland, Ohio.

WANTED.—An Iron Melter capable of running a Colliau Cupola melting 30 tons daily. Must understand how to take slag from slag hole. Write stating experience had and wages expected. Mitchell & Van Meter Co., Linfield, Pa.

WANTED.—A person or company to make working drawings and one patented farm implement for trial. Address Box 701, THE FOUNDRY, Cleveland, O.

WANTED.—Superintendent in a brass manufacturing plant in Chicago. One familiar with modern methods and able to reorganize a plant already established—young, up-to-date man desired—must be non-union. Address Box 689, THE FOUNDRY, Cleveland, O.

WANTED.—Chemist on stove work; experienced in cupola practice. The Wehrle Co., Newark, O.

WANTED.—First class molders for a general line of mill work in union shop. Wheeling Mold & Fdy. Co., Wheeling, W. Va.

POSITIONS WANTED

Undisplayed advertisements will be inserted under this head at 25 cents per line each insertion.

WANTED.—Position as foundry chemist—University graduate, experience in steel works and blast furnace laboratories. Address, Box 675, THE FOUNDRY, Cleveland, Ohio.

WANTED POSITION by young energetic foundry foreman of experience and temperate habits. Well up on light and heavy castings. Expert with molding machines. Address Box 704, THE FOUNDRY, Cleveland, O.

POSITION WANTED.—Foreman patternmaker, wood and metal, A1 draughtsman and designer of molding machines, jigs, dies and tools, 12 years' experience agricultural machinery, desires change. First class references. Address Box 703, THE FOUNDRY, Cleveland, O.

SERVICES together with $2,000 to $6,000 to invest in profitable foundry by experienced man of 32. Nothing but a first class proposition which will bear closest investigation, considered. Address Box 678, THE FOUNDRY, Cleveland, O.

Castings man, twenty-eight, nine years of experience in a foundry manufacturing malleable, gray and small steel castings wishes to change. On the road four years. Practical knowledge and capable of filling any office or outside position. Address Box, 683, THE FOUNDRY, Cleveland, O.

WANTED.—Position as foundry foreman. Twenty years' experience on all classes of work. Country shop in the East preferred. Accustomed to handling market order. Good references. Address Box 684, THE FOUNDRY, Cleveland, O.

WANTED.—Position as superintendent or foreman. Experience in all departments of radiator and cast iron boiler manufacturing, also patterns and flasks for same. Good mixer of iron. Have had good results handling men in the above work. Good references. Address Box 687, THE FOUNDRY, Cleveland, O.

WANTED.—Position. Young man 32 would like to correspond with parties desiring a plant manager or superintendent. Has had eight years' experience—gray iron work—up-to-date systems. At present employed. Address Box 688, THE FOUNDRY, Cleveland, O.

WANTED.—Position as foreman in gray iron foundry. Thoroughly conversant with up-to-the-hour methods and appliances; 18 years' experience; familiar with machines; perfect in cupola practice; best of references. Address Box 691, THE FOUNDRY, Cleveland, O.

WANTED.—Position as Superintendent of Malleable Iron Works. Thirty years' practical experience. Can erect, equip and manage. Highest reference. Address Box 695, THE FOUNDRY, Cleveland, O.

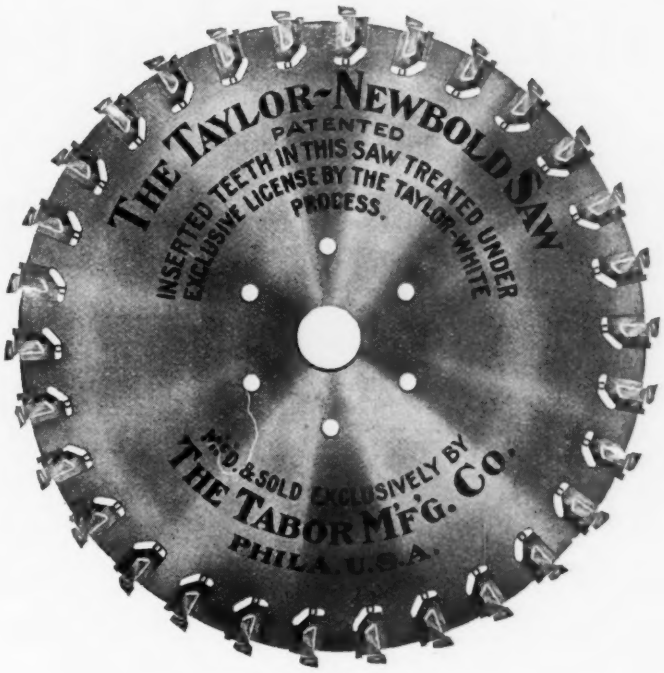
WANTED POSITION.—Iron or brass foundry foreman now employed desires change. 35 years of age, 18 years' experience in the foundry business as molder, coremaker and foreman on heavy, medium and light machinery castings and general jobbing work. Expert with cupola and A1 mixer of metals. Extensive experience in handling difficult work in green and dry sand. Address Box 507, THE FOUNDRY, Cleveland, O.

WANTED.—Position as traveling salesman, by a practical foundryman, 32 years of age, with a large acquaintance among the trade. The right man to sell the right goods at the right price. Address Box 702, THE FOUNDRY, Cleveland, O.

FOR SALE **Large and Good Foundry,** located in Portsmouth, Ohio, where ALL FOUNDRIES are prosperous, for sale at one-half of intrinsic value. Formerly operated in connection with large machine and boiler shops. Rail and river facilities. Address or call upon

SIMON LABOLD, -:- Portsmouth, Ohio.

STEEL FOUNDRIES


THE TAYLOR-NEWBOLD SAW
PATENTED
INSERTED TEETH IN THIS SAW TREATED UNDER EXCLUSIVE LICENSE BY THE TAYLOR-WHITE PROCESS.
MF'D. & SOLD EXCLUSIVELY BY
THE TABOR MF'G. CO.
PHILA. U.S.A.

The Taylor-Newbold Saw

Cuts three times as fast and lasts three times as long as any other saw without regrinding.

Cuts Any Carbon. Removable Cutters. Easily Sharpened.

THE TABOR MANUFACTURING COMPANY

PHILADELPHIA, PA.

28 South Canal Street, CHICAGO, ILL.

Alundum Grinding Wheels

ARE THE LEADERS

The BEST WHEEL for your FOUNDRY
Made in Any Size or Shape
Free and Fast Cutting --- Uniform Quality
Write us for Particulars and Catalogs

MANUFACTURED ONLY BY

Norton Emery Wheel Co.

WORCESTER CHICAGO

Agents in all large cities

THE ONLY MANUFACTURERS IN THE UNITED STATES OWNING AND OPERATING THEIR OWN MINES
THE NATIONAL CORUNDUM WHEEL CO.
BUFFALO, N. Y.

Pure Corundum Wheels

Pure Adamite Wheels

Pure Emery Wheels

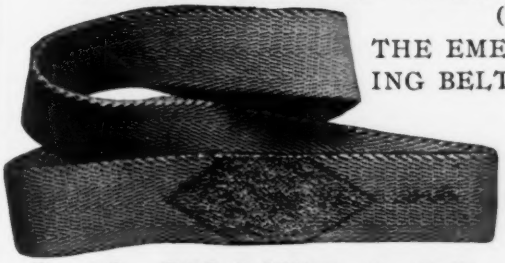
FOR ALL CLASSES OF WORK.

Made upon receipt of order to suit your individual wants. Write for Price List, Testimonials and Scientific Safety Test made by one of the Leading Universities.

The National Corundum Wheel Co.
3010 Main Street, BUFFALO, N. Y.

Gilmer Endless Woven Polishing Belts

(New Patents)



THE EMERY STICKS TO OUR POLISHING BELTS — WHY? Let us show you with a FREE sample belt, that will be the quickest and most satisfactory way we know of to interest you. Are you interested in a high grade FELT wheel? We make them.

L. H. GILMER & CO., Philadelphia, Pa.

THE COMPETENT LIFE

Thos. D. West's latest work

A treatise on the judicious development, direction and employment of man's inherited ability.

Deals with the modern industrial problems.

Price $1.25

The Penton Publishing Co.
CLEVELAND

Motor Driven Swing Frame Grinder

Large range of movement or any angle. Wheel 16 x 2. Special belts.

A money saver.

Write us.

The Bridgeport Safety Emery Wheel Co. (Inc.)

Bridgeport, Conn.

Pike Corundum Wheels

Made of the purest, highest grade Corundum obtainable.

FOR FOUNDRY USE AND TOOL GRINDING

Cool, Free and Fast Cutting

Supplied in all required shapes and sizes.
New 64-page catalogue on application.

Send for price-list and souvenir paper weight, Blotter and sharpener.

Pike Mfg. Co., Pike, N. H.

Every user of a Pike Corundum Wheel is insured against accident by the Casualty Company of America.

TESTED SPEED.....R.P.M. RECOMMENDED SPEED.....R.P.M.

No. 6281

CASUALTY COMPANY OF AMERICA

CERTIFICATE

The operative using this wheel is insured by the CASUALTY COMPANY OF AMERICA, of New York, against personal injuries sustained through the bursting of this wheel, resulting from any defect in the wheel, to an amount not exceeding FIVE HUNDRED (500) DOLLARS, but in no case shall the amount to be paid exceed the actual loss sustained.

In case of claim under this certificate, all broken parts of this wheel, together with this certificate, must be forwarded to the undersigned at the address stated.

This certificate shall not be valid after two years from date of same.

(Signed)—PIKE MANUFACTURING CO.

Dated.....190 Pike, N. H., U. S. A.

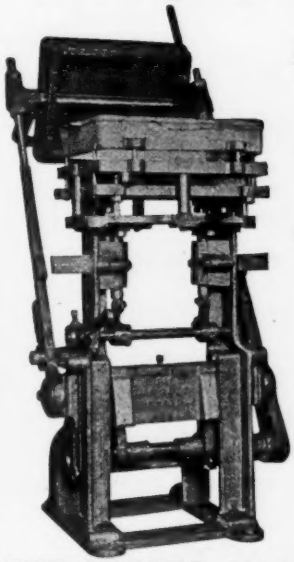
PURE CORUNDUM WHEELS

Will by actual test wear longer, cut faster and give results far superior to any wheels on the market. A trial will convince that this statement is correct.

Trial orders solicited.

The Vitrified Wheel Co.,
Westfield, Mass.

Molding Machines



Automatic Cock Grinders

Automatic Key-Lathes

* * *

Write for Illustrated Catalogue.

THE TURNER MACHINE CO.
2049 North Second Street
Philadelphia, Pa.

CARBORUNDUM FIRE SAND

First—A sample order.
Next—A carload lot.

A short time ago we sold one of the biggest brass concerns in the East a sample order of Carborundum Fire Sand. A few weeks later along came an order for a carload, from the same concern. Naturally we were pleased. So much so that we wrote to them asking if we might refer to them as users of our product. Here is the answer.

The Carborundum Company,
Niagara Falls, N. Y.

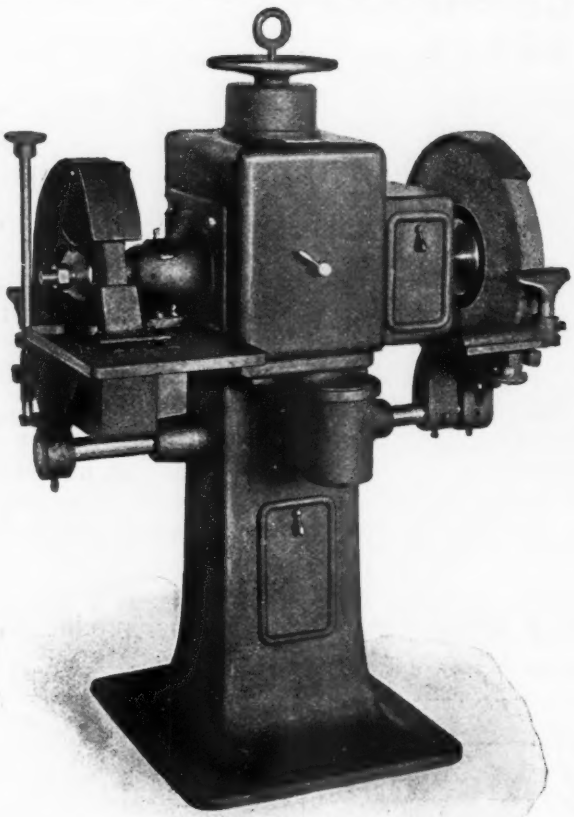
Gentlemen:—We have not the slightest objection to your using our name in connection with Carborundum Fire Sand. We consider it a first-class article. In fact, the best we have yet seen for lining furnaces.

Yours very truly,
ANSONIA BRASS & COPPER CO.
W. A. Cowles, Gen. Supt.

Carborundum is especially valuable in lining or repairing furnaces. It is highly infusible and is not affected by the chemical action of acids or gases.

The Carborundum Company NIAGARA FALLS New York

J. W. JACKMAN & Co., LTD.
39 Victoria St., London, S. W. Eng.
Agents for this material in Great Britain.



Three reasons why we consider our

Multi-Speed Electric Emery Grinder

The best of its kind.

SIMPLICITY OF CONSTRUCTION !

The motor is self contained—No auxiliary apparatus, Rheostat or controller being used—They get out of order—*Our hand wheel and plunger don't.*

WIDE RANGE OF SPEED !

Our motor has a much wider range of speed than the ordinary commercial o e.

INFINITE VARIETY OF SPEEDS !

This is its crowning advantage for emery grinding—by simply turning the hand wheel on top of machine *every conceivable speed* between the highest and lowest points can be given and the speed of the emery wheels can be regulated *to the fraction of a revolution !*

The above illustrates our combination wet and dry grinder.
We build them for dry grinding only, when desired.

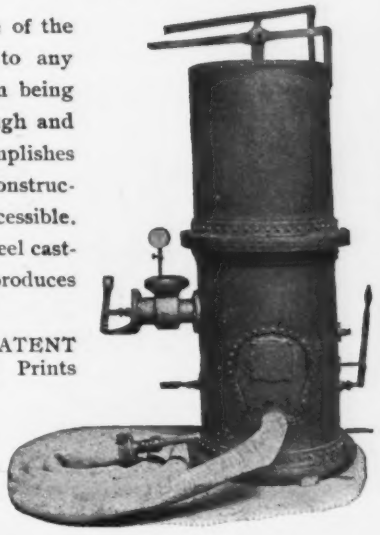
STOW MFG. COMPANY, Binghamton, N. Y.

Gen'l European Agents—Selig Sonnenthal & Co., 85 QueenVictoria St., London, Eng.

The Improved Sand Blast

More commercial value is attached to the use of the Tilghman-Brooksbank Sand Blast Machine than to any process of metal cleaning now in use. Apart from being more economical, this system is much more thorough and rapid. Ordinarily an operator with our machine accomplishes more than five or six men using other devices. Its construction is simple and the interior mechanism is easily accessible. The Sand Blast cleans perfectly, brass, iron and steel castings, removes paint and scale from all metals, and produces a satin or frosted finish to such materials.

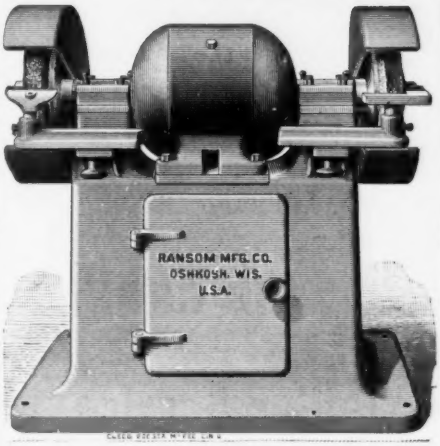
We have also in connection with the above our PATENT EXHAUST SYSTEM. Particulars and Blue Prints furnished on application.



Please address envelope containing inquiries to Dept. C.

Tilghman-Brooksbank Sand Blast Co. 1126 South 11th St., PHILADELPHIA, PA.

MOTOR DRIVEN DRY GRINDERS



Furnished with variable speed motors. Send for pamphlet.

RANSOM MFG. CO.
OSHKOSH - - - - WIS.

The Injector Sand Blast Apparatus.

If Interested in Efficient, Quick, and economical Cleaning of Castings, Write for Circular to

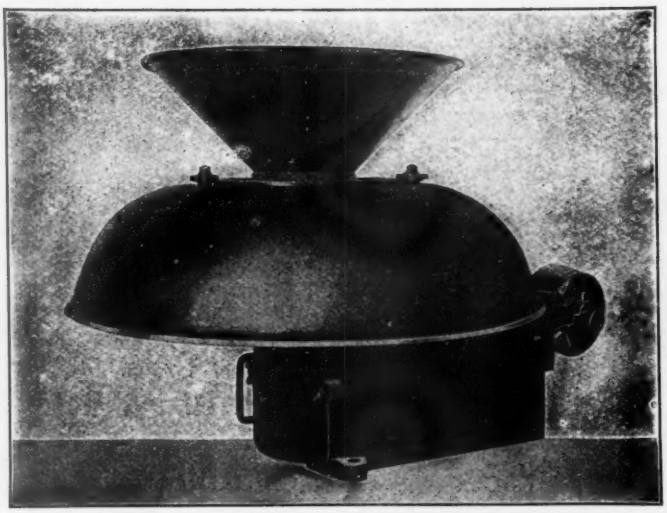
C. DRUCKLIEB,
213 Reade St., New York.

William Sellers & Co., Incorp.

PHILADELPHIA, PA.

Modern Machine Tools

We illustrate hereunder one of our specialties for Foundry use, which has proved very satisfactory and profitable in service.



Centrifugal Sand Mixing Machine

We have furnished these machines to many users and shall be pleased to supply full particulars upon application.

TRAVELING CRANES JIB CRANES

SHOP TURNTABLES

Improved Injectors for Boiler Service

SHAFTS, HANGERS, PULLEYS, COUPLINGS, Etc.

FOR THE TRANSMISSION OF POWER.